

University of Cape Town

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## **Metallic Links: for the integration of city to sea and people to city**

Design Research Project APG 5058S  
Submitted in partial fulfillment of the requirements for the degree  
Master of Architecture (Professional)

by  
Ryan James van der Vyver

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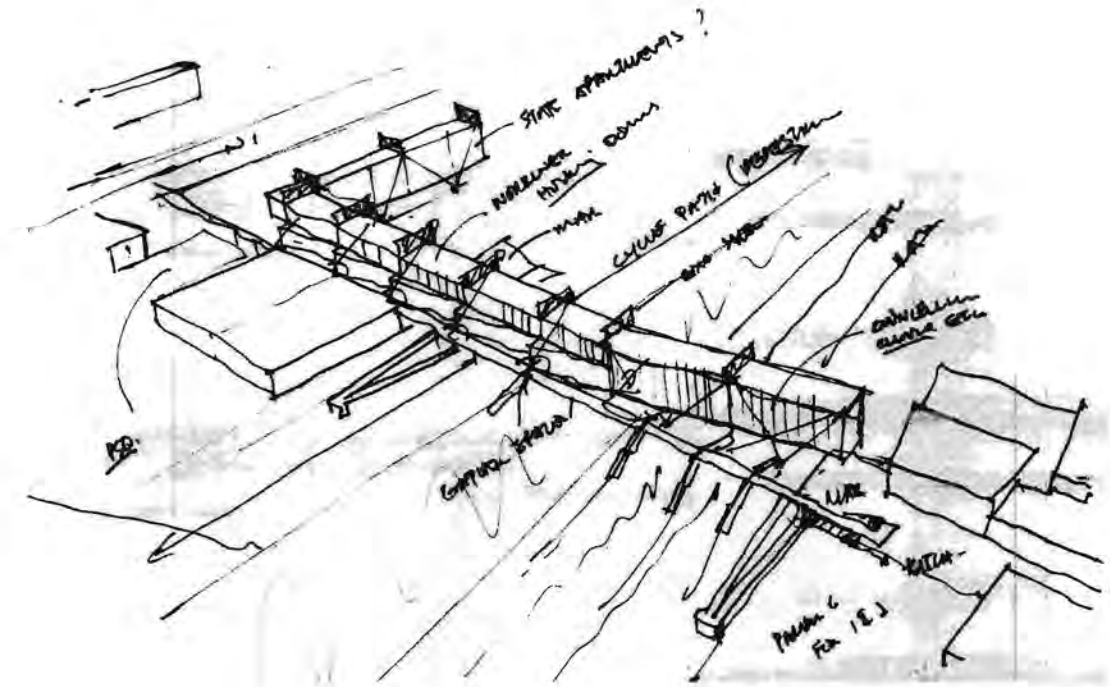
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# introduction

This thesis began with an idea of barriers that created discontinuities and fragmentations within our city core, prohibiting movement and access in and around the CBD. The cities transport infrastructure is one of the primary reasons for these barriers. Within this initial idea the design approach was to select a site where the overriding characteristics were reflective of barrier, discontinuity or isolation. Culemborg goods yard seemed the most appropriate site to explore an architectural intervention that would intend on integrating this barrier by means of a series of links originating from the exiting urban fabric extending into the harbour. These links would in essence act as life lines that begin to set up the potential future development of the vacant industrial site, while supporting the growing harbour and creating opportunity for the hundreds of unemployed people entering into the city. The starting point for this bigger design idea is at the one point where the Culemborg barrier is penetrated by and existing pedestrian bridge. This bridge links Woodstock station to Espanade Station to a new BRT Stop, (within the Culemborg site) that then continues over Culemborg Industrial site, over the N1 Freeway ending in the harbour.

The site specific design approach lead the thesis into the theoretical research of Space Syntax theory, and the theories revolving around the conditions of lost spaces, namely Place, Linkage and Figure Ground Theory. The technological component gained inspiration from the location and social conditions of the site, that led the research into the fields of ship construction, metal surfaces and the prefabrication genius of Jean Prouve. Following these investigations the design explored a variety of techniques in order to build a layering of information of the site and its surrounds. These techniques ranged from Lynch maps, to architectural sections, interviews, scientific analysis and abstract drawing of the site and its surrounding context. Through the layering of these various systems the site presented a number of opportunities with regard to urban design strategies as well as to the materiality and making for the proposal of an architectural intervention that is both bridge and building.





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# Introduction

The first page of the report is a title page, which is followed by a table of contents. The table of contents lists the chapters and their corresponding page numbers. The first chapter is an introduction, which is followed by a chapter on the history of the city. The third chapter is a description of the city's current state, and the fourth chapter is a description of the city's future. The fifth chapter is a conclusion, and the sixth chapter is a list of references.

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# section 1

## The Need

This thesis has taken a on a site specific design approach that was initially conceived in the idea of barriers within our city. The barrier or barriers in this instance is the post industrial landscape of Culemborg that currently acts together with the N1 freeway as a barrier between Woodstock, Salt River and Observatory to the surrounding coastal areas as well as access to the site itself. This place is a lost space that needs to be integrated into the urban fabric. In this lies the opportunity or need for an architectural intervention that will begin to integrate or break down this barrier. The barriers discussed here are not isolated to Cape Town or South Africa but is a consequence of the post industrial city that is further explained in the theory component of the document. In general terms these barriers include highways, railroad and waterfronts where major gaps disrupt the overall continuity of the city form. Pedestrian links between important destinations are often broken (Tancik: 2).

## The Design Vision

The design vision is thus to approach the barriers set up by the transportation infrastructure and the post-industrial landscape of Culemborg goods yard with the design intention of identifying strategic points with which to integrate the area into the existing urban fabric of Woodstock and the harbour. The points are intended to extend the links from the city to the sea while they become places of opportunity and empowerment for the building users. These links essentially become the life lines that begin to set up the potential future development of the vacant industrial site, while supporting the growing harbour and creating opportunity for the hundreds of unemployed people entering into the city on a daily basis. The vision is thus to transform an area that was previously a barrier and desolate 'waste land' into something that can literally and figuratively act as a bridge that begins to integrate the city to the sea and previously disadvantaged people into the city.

## The Design Methodology

The design methodology was set up through the identification of a site that was relevant to the initial creative interests. The site both in its physical and social attributes would then form the basis for the theory, technology and design explorations. Therefore by means of this method it was important to extract a thorough investigation of the site extruding as many layers and systems that have made the site what it is today. Therefore In the theory document the exploration is taken through theories of space syntax that analyze the greater urban condition of the site which had then helped to orientated the area in the theories of lost space, explained by Roger Trancik through a number of urban design theories.

From a technical exploration the site offered a richness of exploration opportunities. Firstly the harbour in reference to ship construction, the use of metal and sheet metal which thus lead to an investigation in architectural metal surfaces. The social condition of the site further stimulated the idea of involving people from the area in the buildings construction which was then investigated by means of prefabrication and the making of prefabricated components. Prefabrication was researched through the work of Jean Prouve, a prefabrication visionary.

Figure 1  
Culemborg site in Cape Peninsula Context (Google  
Earth: 2011)

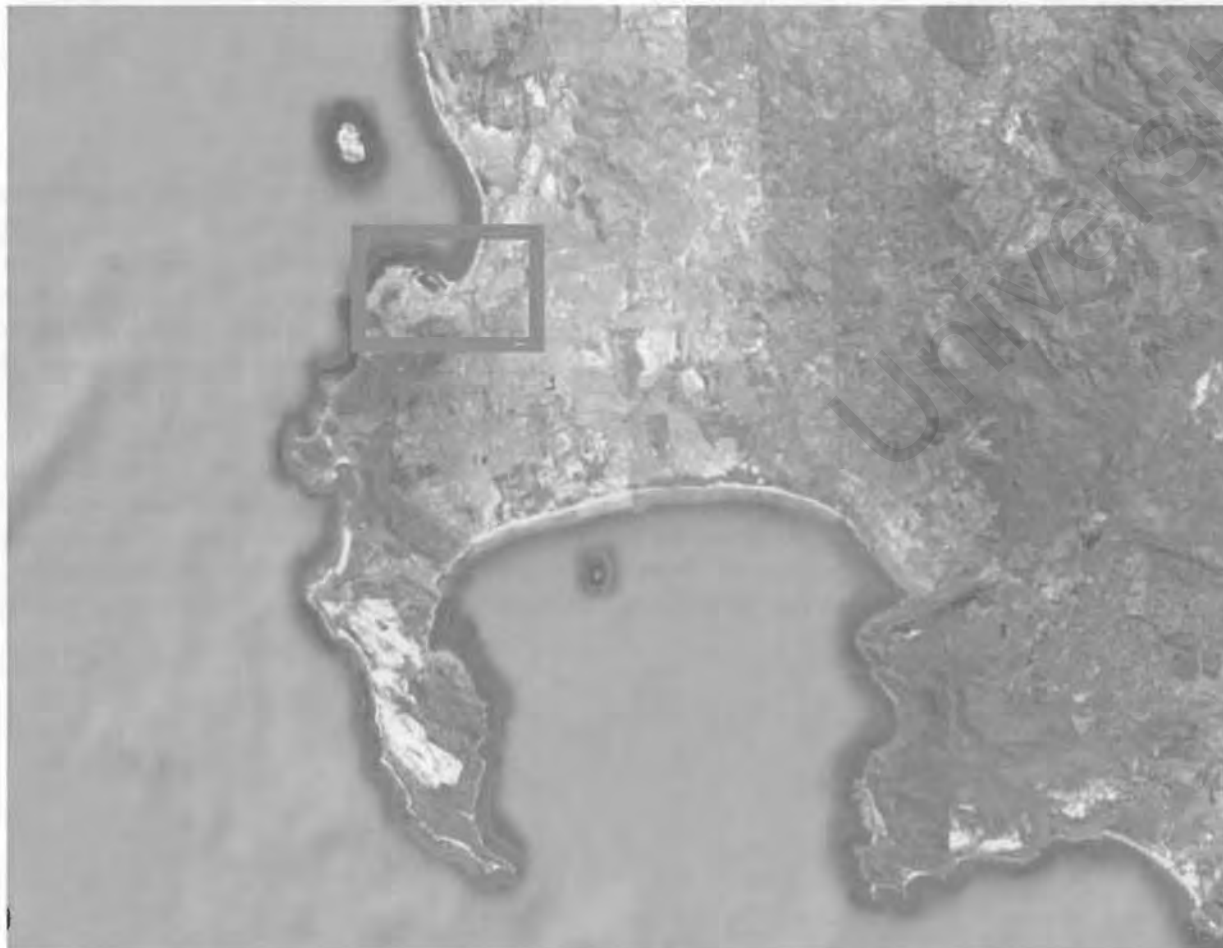


Figure 2  
Culemborg site in Cape Town Context



Figure 3  
Space Syntax Diagrams (Dovey & Dickson, 2002)

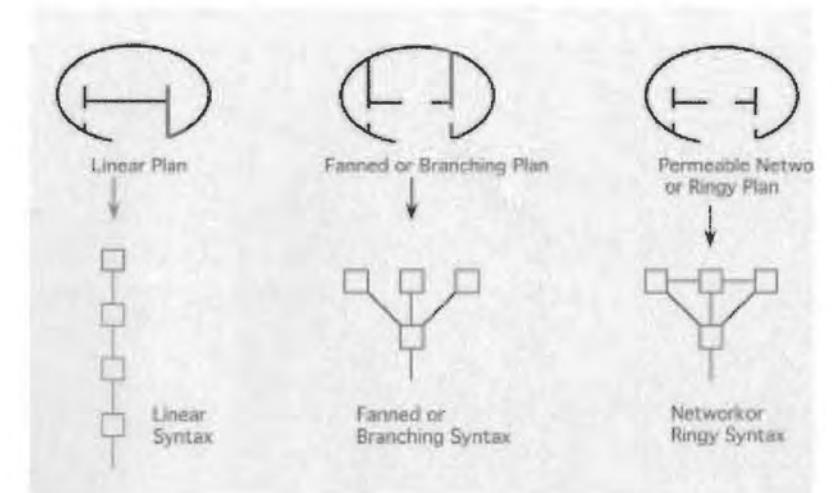






Figure 8  
Figure 4 ground with vehicular and pedestrian movement sys-

## section 2

### THEORY RESEARCH SUMMARY

The initial creative interest of barriers set up by the transportation infrastructure is the main cause for the lack of access and integration in and around the Cape Town CBD. These conditions originated in Apartheid spatial planning that used the transportation infrastructure such as railway lines, freeways and industrial lands to act as barriers in order to separate people and places. The resulting conditions which in this case is represented by the Culemborg goods yard is an industrial wasteland that has created a disruption and disconnection in the city's urban fabric. The approach therefore was to investigate the fundamental elements of the of Space Syntax theories in order to illustrate the conditions that result as a consequence of these lost spaces. This was then carried out by means of a simple axial map analysis of Culemborg and its surrounding urban conditions. The findings of this basic analysis are further investigated through the urban design theories revolving around the conditions of Lost Space that include figure ground, linkage and place theory. From this investigation it became apparent that the Culemborg Lost space condition is one not isolated to Cape Town or South Africa, but is rather a consequence of the post industrial city and not necessarily a direct result of Apartheid spatial planning, although this has also left its mark in the segregated make up of our city. By means of this theoretical investigation the intention was to find a strategy whereby the barrier set up by the conditions of Culemborg becomes a place of integration as opposed to separation. This was then looked at in terms of a strategy based on the principles of the integrated bridge, illustrated in the example of Ponte Vecchio

### Space Syntax Theory

The theoretical exploration began with an interest in the theories of space syntax, looking particularly at the syntactic analysis described in Space as the Machine which translates the building plan or settlement structure into a diagram of how life and social encounter is framed within it. These diagrams were developed in order to bring an understanding of how the configuration of space can be influenced by or influence a configuration of people. The diagrams alongside (figure 3), illustrate quite powerfully how similar plans with different access points yield quite different syntactic structures and illustrates three primary cluster relations, the string (or known in architecture as the enfilade) with no choice of pathway, the fan (or



Figure 5  
Axial map

branching) structure with access controlled from a single segment and the ringy network or permeable structure with multiple choices of pathway. Inevitably architecture involves all three.

In reflection of the theoretical component, the theories offered by space syntax helped bring a better understanding of spatial configurations and the consequences associated with them by means of the three diagrams listed above. These initial readings were extended into the ideas of integrated spaces and non integrated spaces which initially felt increasingly appropriate in relation to the design vision. Some of these theories were then tested over the greater project site by means of a simple axial map analysis (figure 4 & 5) of the Post Industrial Culemborg goods yard that revealed the fragmented movement and relating isolated urban spatial structure of this particular part of the city.

### Culemborg as Lost Space

Therefore in reflection to the spatial syntax axial and movement analysis of the Culemborg site there is a clear lack of integration with its surrounding context. The physical conditions of the site and its location within the city core, raise questions into its making. These questions required an investigation into urban design strategies that would locate the Culemborg site within the post industrial landscape. It includes the fundamental changes in the makeup of the city from the industrial revolution (19th Century) until the present that have resulted in these strategically placed desolate wastelands in the city core. The work of Cedric Price, 'Three Eggs Diagram' (figure), is an important reading in that it clearly summarizes the progression of the city described above. The diagram explains that the ancient or traditional city is described as a dense, "hard boiled egg", fixed in concentric rings of development within its shells or walls. Following this diagram the "fried egg" city, created a star shaped urban form caused by the advancement of railway transportation stretching the city form in linear corridors into the landscape. Finally the post modern city is characterized as the "scrambled egg city" with its form of distribution across the landscape in a polycentric network. (Shane, 2004). The relevance of this research is that the industrial city left behind an urban infrastructure characterized by industrial land close to the city core, whereas the post industrial city brought urban





Aerial photo: mlh architects & planners

The city as an egg, Cederic Price



Figure 6  
(Gray, 2006)

sprawl and development at the city fringes. Culemborg goods yard is one of the sites left behind by the industrial city. It is an area that consists of numerous storage facilities, large scale transport infrastructure and large expanses of degraded and contaminated open land (figure 2). These sites according to Roger Trancik, can be described in terms of lost space. These sites that are comprised of large vacant land are not isolated to Cape Town but form part of a condition for every modern city. Although this space in its current state creates discontinuity and barrier within the existing urban fabric, they also provide exceptional opportunities to reshape an urban centre (Trancik: 2). Generally speaking lost spaces are the undesirable urban areas that are often found, along highways, railroad lines and waterfronts. Therefore in the recognition of its urban condition Roger Trancik puts forward a number of urban design theories that can be used as a means of addressing these spaces and the barriers that isolate them from the existing urban fabric, the theories are the urban design theories of Figure Ground, Linkage and Place Theory (figure 7).

#### Design Principles Addressing the Integration of Isolated Sites

In response to these conditions an architectural intervention can be approached, according to Roger Trancik in five physical design principles that are key concepts for the creation of integrated urban space. These principles include: Linking Sequential Movement; Lateral Enclosure and Edge Continuity; Integrated Bridging; Axis and Perspective; Indoor/Outdoor Fusion.

Out of these principles, the principle of integrated bridging deals with the concerns of immovable boundaries, like the transport infrastructure that surrounds the Culemborg site. The Ponte Vecchio Bridge in Florence, Italy (figure 8) is a perfect example of integrated bridging. It is a structure that can be described as a building that is a bridge and a bridge that is a building. The two functions are successfully integrated into one form. This principle can be applied when blockages or barriers in the city's fabric need to be overcome and when elevated pedestrian platforms and bridges are necessary to retain

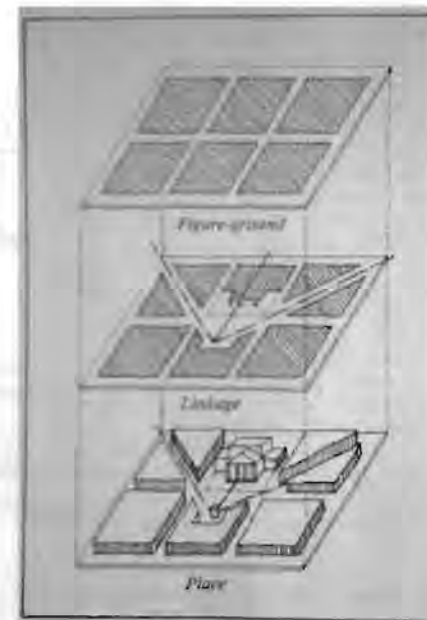


Figure 7  
Diagram of Urban Design Theories (Trancik, 98)



Figure 8.  
The Ponte Vecchio, Florence, Italy  
(Trancik: 225)

A building that is also a bridge, a bridge that is also a building, the Ponte Vecchio built during the Renaissance by Neri di Fioravanti illustrates the possibility of using bridging devices to overcome gaps in the city fabric. In the modern city, elevated passageways integrated with buildings can, like the Ponte Vecchio, serve as a link between disconnected urban areas.

spatial continuity. This can also be applied to reclaim leftover space between districts that segregates continuity in urban form. Through the integration of buildings and activities by means of this bridging it is possible to design continuous pedestrian spaces without the negative gaps that often disrupt the spatial flow. The goal is to strive for an uninterrupted mesh of activities in public spaces such as that which occurs at Ponte Vecchio. The bridge becomes an armature of connections or a coherent system of pedestrian ways onto which buildings can be glued (Trancik: 225).

## Conclusion

The report has explored the fundamental elements of space syntax theory, by means of simple axial map analysis, of the Post Industrial Culemborg goods yard that revealed the fragmented movement and relating isolated urban spatial structure. The site forms a barrier in the context of the city, a disruption in the urban fabric. But in the same breath this barrier offers endless creative opportunity. A strategy for the integration of the Culemborg barrier was supported by the urban design theories of Figure Ground, linkage and Place Theory. The combination of these theories provides the opportunity for the barrier, to move beyond the place where something stops, into the place where something begins to present itself. Therefore the boundaries within our urban centre should not be considered as problem areas, but rather areas of filled with opportunity, for it is at the boundary that the city expresses its most important social places (Sennett, 484).



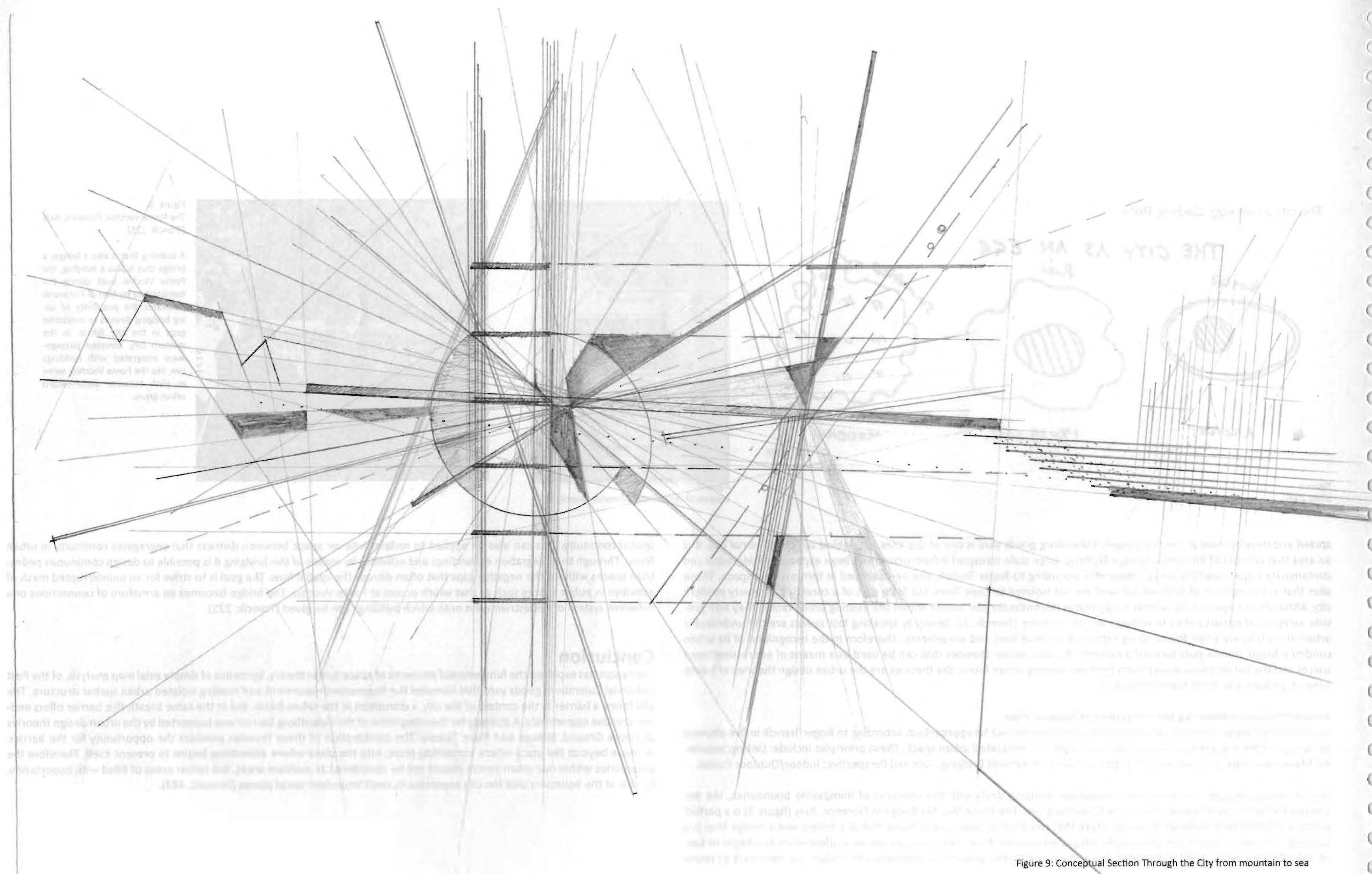


Figure 9: Conceptual Section Through the City from mountain to sea

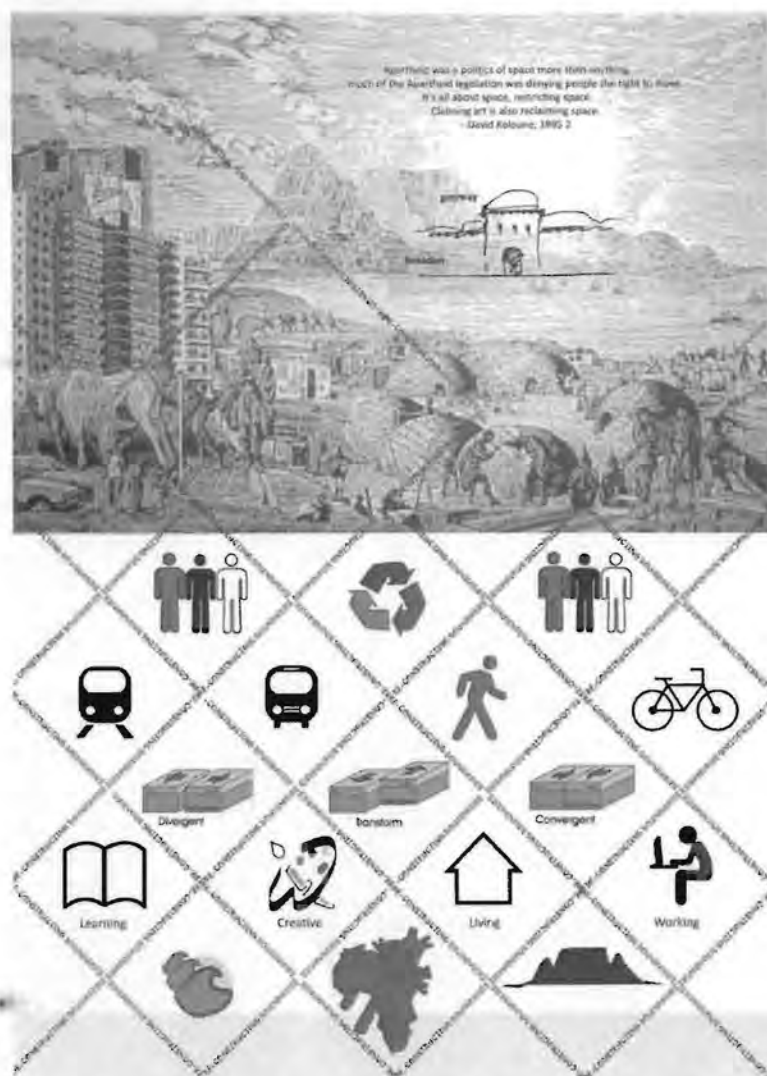


Figure 10

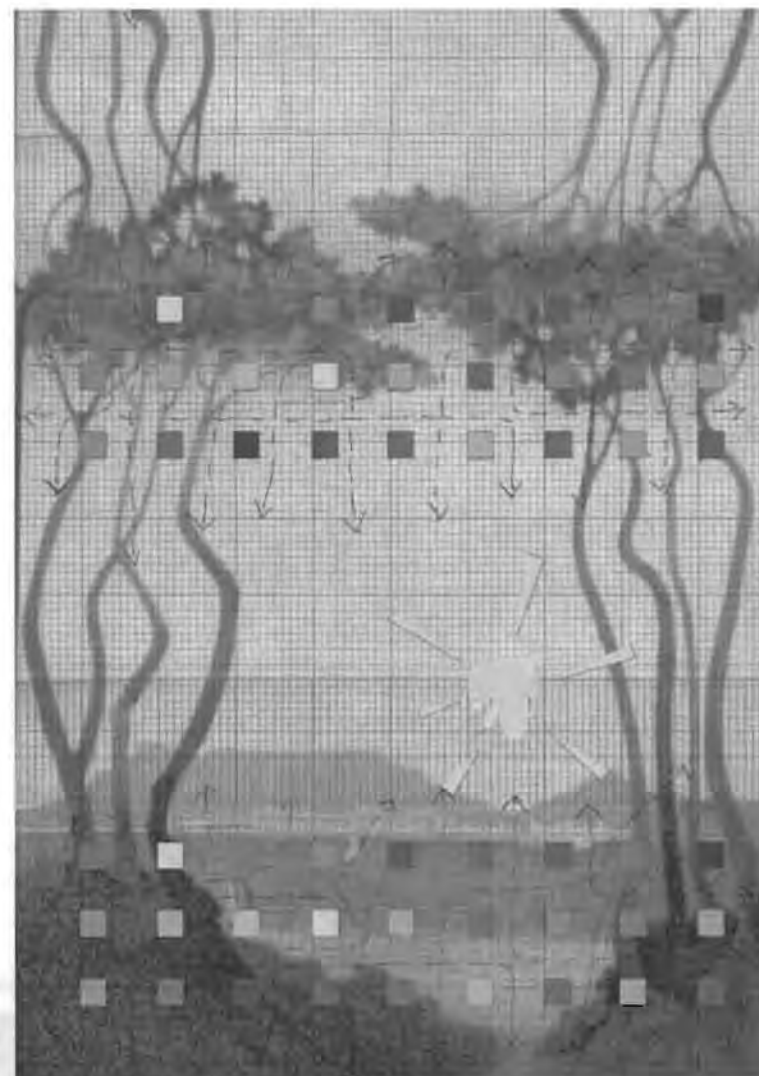


Figure 11

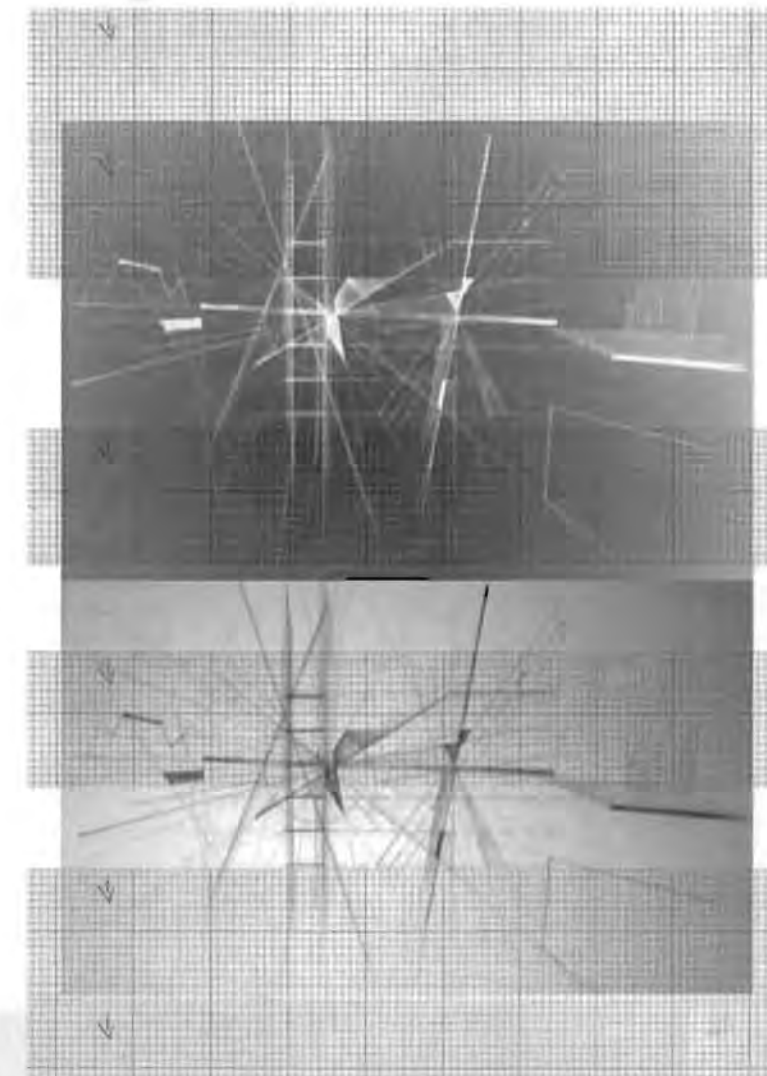


Figure 12

## section 3

### DESIGN EXPLORATION

#### Design Intention

The design intention has stemmed from the identification of the Culemborg site as a barrier that is strategically placed within the city core. This large area offers fantastic opportunities for future development of city and is the key to integrating the areas of Woodstock, salt river, Observatory and re-establishing a city sea connection. It is with this in mind and with the strategies established in the theoretical component of the research that the project's intention is to create a series of integrated bridges that extend the links originating from the city's existing built fabric across the industrial wasteland of Culemborg and connecting it with the harbour. The bridges are not simply to be access points to the harbour, but are intended to be integrated with appropriate programme that grows at strategic points along the journey from Woodstock to the harbour. The growth points will begin to hint at strategies for future development of the larger Culemborg area. The integrated bridges proposed here thus become life lines that will support our growing harbour but more importantly are facilities that are aimed at integrating and filtering previously disadvantaged people into the city, through a means of temporary accommodation, assessment and skills development.

#### Design Approach

The initial creative interest as mentioned earlier was illustrated in a number of conceptual drawings that was focused on the idea of barrier. Barrier in this instance makes reference to the transportation infrastructure that has created a great amount of discontinuity and disruption in our urban fabric. These concerns are illustrated in the conceptual drawing in figure 9. The drawing is intended to read as a section through the city, from mountain to sea, that has been disconnected by the many layers of transport infrastructure. A development of this initial idea is represented in a series of drawings illustrated in figures 10, 11, 12.

The approach was then to take these ideas and search for a site where the overriding characteristics are reflective of barrier, discontinuity or isolation. The reasoning in this was to find something tangible with which to work and for the conditions of the site both physical and social to stimulate a design process and exploration. It was not long before the vast isolated and desolate area of Culemborg became increasingly appealing as a potential site for an architectural intervention that would attempt to integrate the barrier created by this industrial waste land. This site therefore felt the most appropriate place to begin an investigation that would help stimulate the initial creative interests expressed above.



Figure 13 Pedestrian Bridge Running over Culemborg Goods Yard



Figure 14 Pedestrian Bridge Running over Culemborg Goods Yard



Figure 15 Location of existing pedestrian bridge within context of Culemborg and City



### Site Selection

As mentioned above the site selection of the project was established early on in the process. The central issue to the site and the primary reason for its selection for this thesis is that the site poses a physical barrier to local inhabitants of Cape Town (see figure). This large area of land currently acts, together with the N1 freeway, as a barrier between Woodstock, Salt River, Observatory the surrounding coastal areas as well as access to the site itself. Due to the incredible scale of Culemborg it is the focus of this thesis to concentrate on a point where this barrier is penetrated. Currently there is an existing pedestrian bridge that links Woodstock station to Espanade Station to a new BRT Stop, (within the Culemborg site) that then continues over Culemborg Industrial site, over the N1 Freeway and finally ending in the harbour. Therefore this existing pedestrian bridge becomes the starting point for the architectural intervention described in the design intention and vision for the project. The location of the bridge can be seen in figure 15, illustrated by a single red line that connects woodstock to the harbours edge. The bridge is approximately 400m long.

The selection of the site was also supported by the city's future development plans that currently incorporates road improvements, proposed links with the Port, N1 and the new BRT corridor that will provide future access to the area as well as to deregulate some Port security constraints making the re-connection with the coast a possible future reality. (Cape Town Partnership, 2008) Furthermore it was also important to look at the plans for the Cape Town harbour, which is illustrated in the two maps in figures 16 and 17. These maps show the harbours land use in 2010 and where the harbour intends to develop by 2040. What is particularly interesting in these maps is the growth of the ship repair industry over the area that is currently Yacht club. This adds value to the design idea for the creation of a series of bridges that intends on supporting this growth, while offering opportunity for skills development and job creation.

The architectural design approach was then to work across many different techniques in order to build a layering of information of the site and its surrounding context. The following pages document this research which starts with a social investigation of the selected site area. From here the research looks at the site through the lens of its History and Heritage, ecological Context, Transportation Infrastructure, with regard to spatial barriers and discontinuities, Topography of the site in relation to the rest of the city bowl, climate, visual connections and land use. Through the layering of these various systems and social conditions, the site was presented with a number of opportunities regarding its urban strategy all the way to its materiality and making.



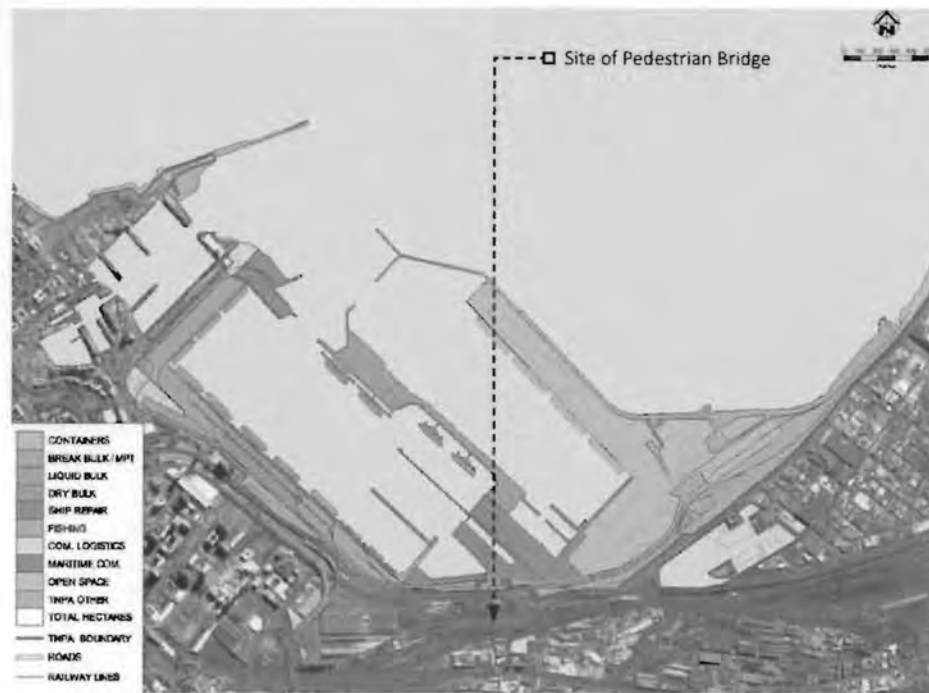


Figure 16: Current Harbour zoning 2010

Area of interest in term of this thesis is the growth of the ship repair industry indicated by the blue area in front of the culemborg site

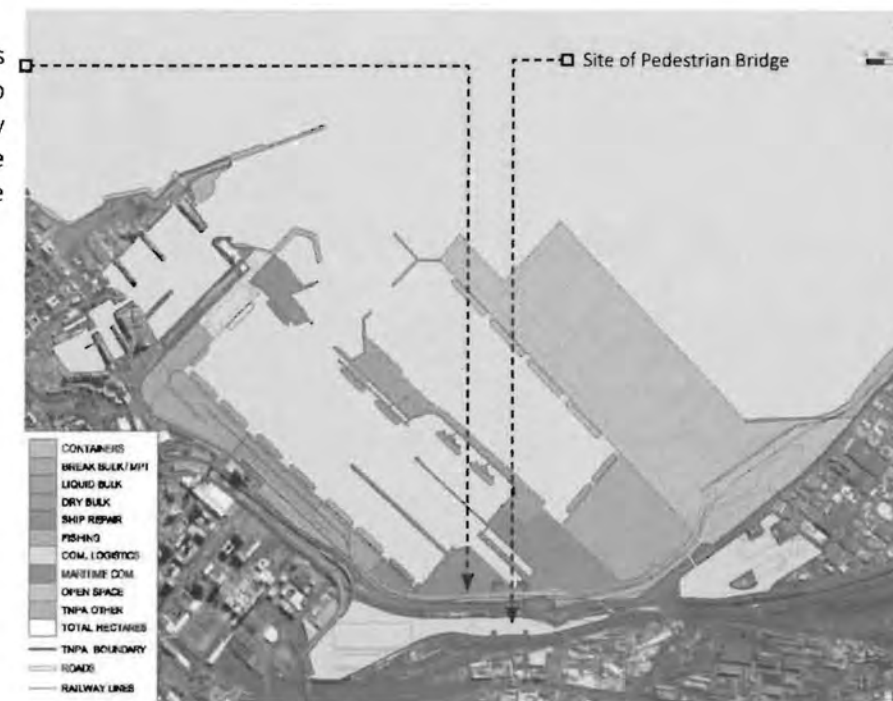


Figure 17: Future Development Plans for the Harbour 2040

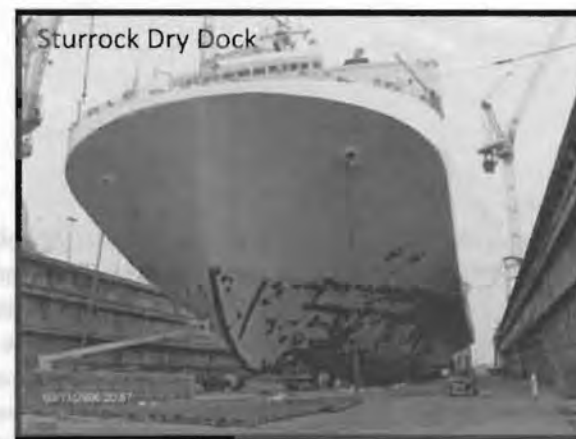
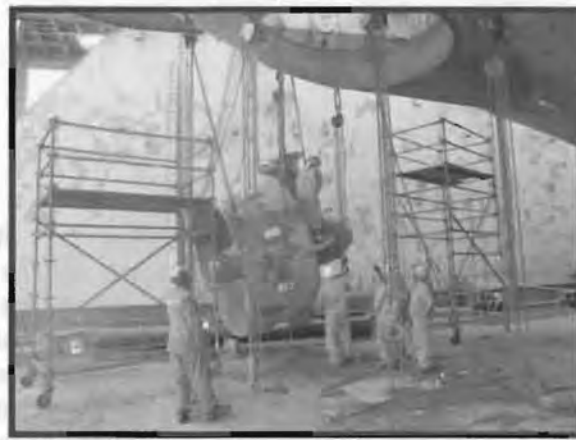


Figure 18: A series of images representing the available work and required skills development for people working in the harbour.



Figure 19: Hundreds of People waiting at the end of the pedestrian bridge in the hope of finding work.  
Author

Figure 20: Carpenter Center, Roelof Street Cape Town.  
Images Author



### Site Analysis

#### The social condition

The first step was to begin to understand the social dynamic of the area. This investigation was carried out through a series of casual interviews with people working in the area and frequently using and existing pedestrian bridge which runs from the Woodstock station over culemborg and the N1 landing in the harbour. These interviews established that the people coming into the city were from all over Cape Town Peninsula and mostly from previously disadvantaged backgrounds. Most of these people were unemployed men and women, coming to the harbour in search of work. One of the main gathering points for these people is outside the doors of the marine time company DCD Dorbyl which amongst other things is involved in the ship repair industry. The skills that are required in the industry are extensive and involve opportunities in the areas of welding, grinding, sand blasting, painting, all of which is illustrated in the figure 18.

The issue in this case is that many of the people that come to the harbour end up waiting around in the hope that they are given an opportunity to work (figure 19). However many are left to stand around exposed to the elements and without any available amenities or guidance for other potential opportunities within the city. Although they come into the city they still remain isolated and seemingly unable to filter or penetrate the cities doors. Therefore a critical layer to these initial investigations was in understanding the role that the harbour could play in terms of jobs and skills development. This research was focused on ship repair due to the sustainable nature of the skills required for these projects and the potential for these skills to provide opportunity in other areas of the economy.

Cape Town harbour is the closest port to the West African Oil fields, while the offshore vessels are too large to go through the Suez Canal and therefore come round the Cape. Currently the harbour provides 6000 jobs directly or indirectly and has the potential to rise to 10 000 people if the harbour is running efficiently. Furthermore as illustrated in figure 17 the harbour is looking to increase the size of its ship repair industry, and by 2040 they are looking at converting the whole area of the yacht club as an extension of this industry .

From this initial social investigation the research then began to look at facilities within Cape Town that work with unemployed people particularly with regard to skills development. The carpenter center is one of these facilities. The facility offers skills development in woodworking and has both a glass recycling studio and small car repair garage. Finally it also offers gateway accommodation that sleeps 8 people to a flat. The gateway accommodation is the last step to a long process of assessment and reintegration of people from a point of unemployment to a point where there can successfully reintegrate into society. The images alongside illustrate the facilities that are provided and helped to begin the process of 'programming' a building that is both intending to integrate the physical barriers posed by culemborg but also to integrate the potential building users into the city through a means of skills development and job creation. The realization in this investigation is that architecture cannot achieve all these ambitions. However a step in the right direction is a facility that offers a thorough process of assessment that extends over a period of 7 days, can create the opportunity for the correct placement and orientation of these people into the city. Importantly the facility cannot work on assessment alone and would therefore require temporary accommodation over the 7 day period. A skills development facility should also be provided if the people coming out of the assessment period are appropriately suite for whatever skill development is on offer.



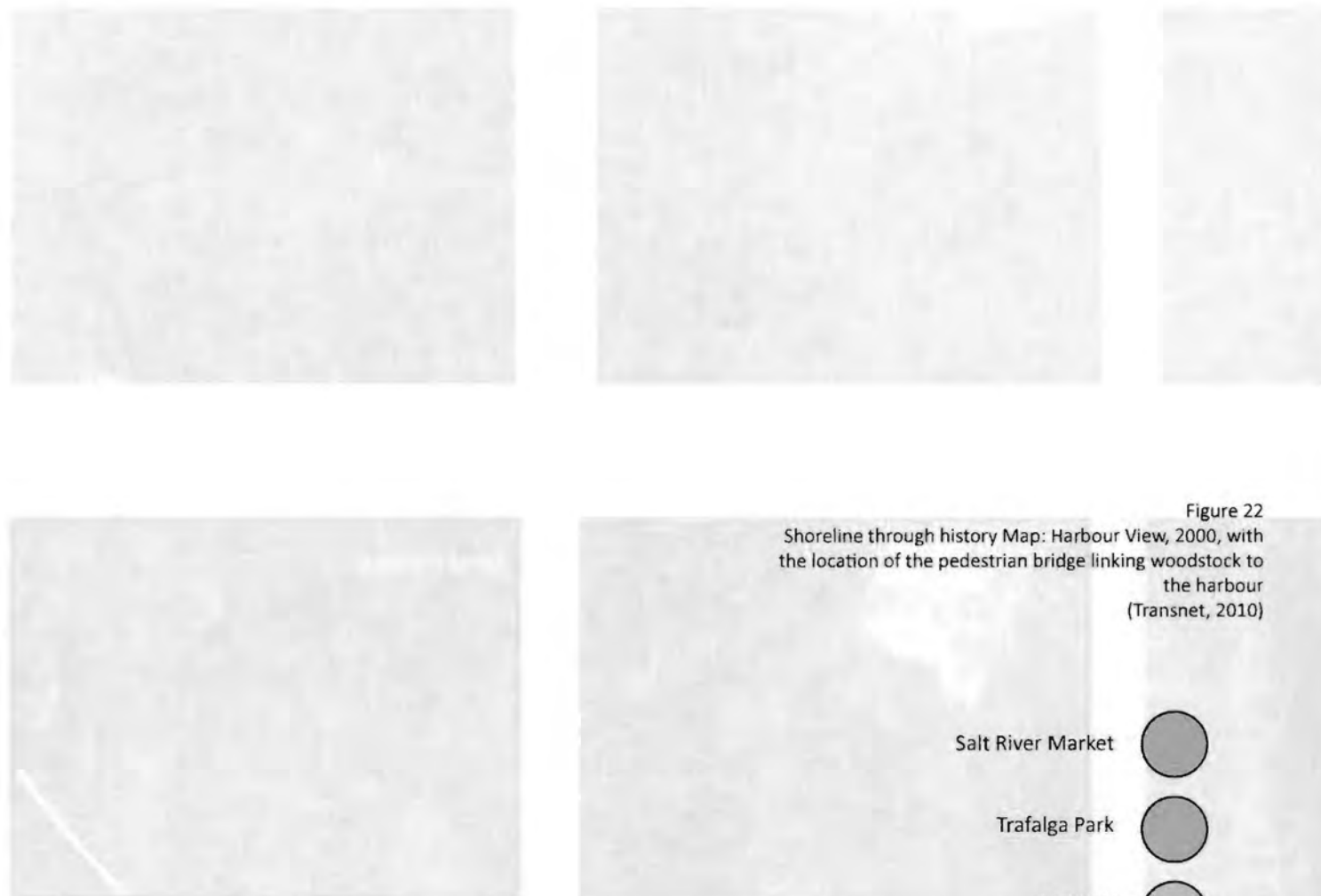


Figure 22  
Shoreline through history Map: Harbour View, 2000, with  
the location of the pedestrian bridge linking woodstock to  
the harbour  
(Transnet, 2010)

- Salt River Market
- Trafalga Park
- District 6
- Good Hope Center
- Castle of Good Hope
- Duncon Dock
- Yatch Club
- Old Wood stock Ocean Front



Figure 21: Heritage and History

1. Green Point Common
2. Company Gardens
3. Trafalga Park
4. Diep River Vlei
5. Salt River Canal
6. Liesbeek River Park
7. Black River Park
8. Rondebosch Common
9. Keurboom Park
10. Western Province Sports Ground
11. Table Mountain National Park



Figure 23: Ecological Context (Roos, 2009)



### History and Heritage of the Area

The Culemborg goods yard is on reclaimed land which can be seen through figure 22, illustrating the changing shoreline of Cape Town from 1890's until the present. One map shows the old shoreline from 1890's, compared to the shoreline in 1920's and in 1945 when the landfill was completed. Officially, the decision to reclaim the foreshore was made in 1937 (Harbour View, 2000). The first use of the area was of a military kind and railways were established across the site already in 1860 (City of Cape Town, 1997). After the Second World War it was developed as a central goods yard, but wasn't in use for long because the road based goods distribution had taken over (Harbour View, 2000). For most of the time the Culemborg goods yard has been used for storage, shorter leases and has been generally under utilized. Apparently the current railway platforms have never really been used as intended (Burls, Nigel). Figure 21 illustrates the location of the significant sites regarding History and Heritage of the area.

### Ecological Context

Due to the fact that the Culemborg site is a vast open area of land the project aims needed to consider the potential for future development and therefore take on an urban design strategy into which the series of bridges could fit and begin to set up future development of the area. With this in mind it was important to look at both the built fabric of Woodstock and surrounds but also the ecological context and establish certain green links that would become organizing features of a potential future development. To further support this decision Cape Town is famous for its natural beauty and it should therefore be important that the natural elements of our city be used to set up the future developments. These links would also then establish important points at which the bridges penetrate the Culemborg barrier.

Figure 23 illustrates the ecological context of the city in relation to the site. From this map one can begin to detect the possible future scenarios of linking green corridors in a web like fashion throughout the core area of Cape Town. In this sense it is important to consider the existing biodiversity corridors as well as plan for future development emphasizing mountain sea and mountain river connections. The Culemborg site possesses the possibility of integrating a north south mountain sea connection as well as an east west river corridor connection that could allow for a green spine running through the centre of the proposed development. This green corridor can then act as a natural buffer or soak away for high urban storm water runoff (Roos, 2009).

Figure 24: Railway Reserve

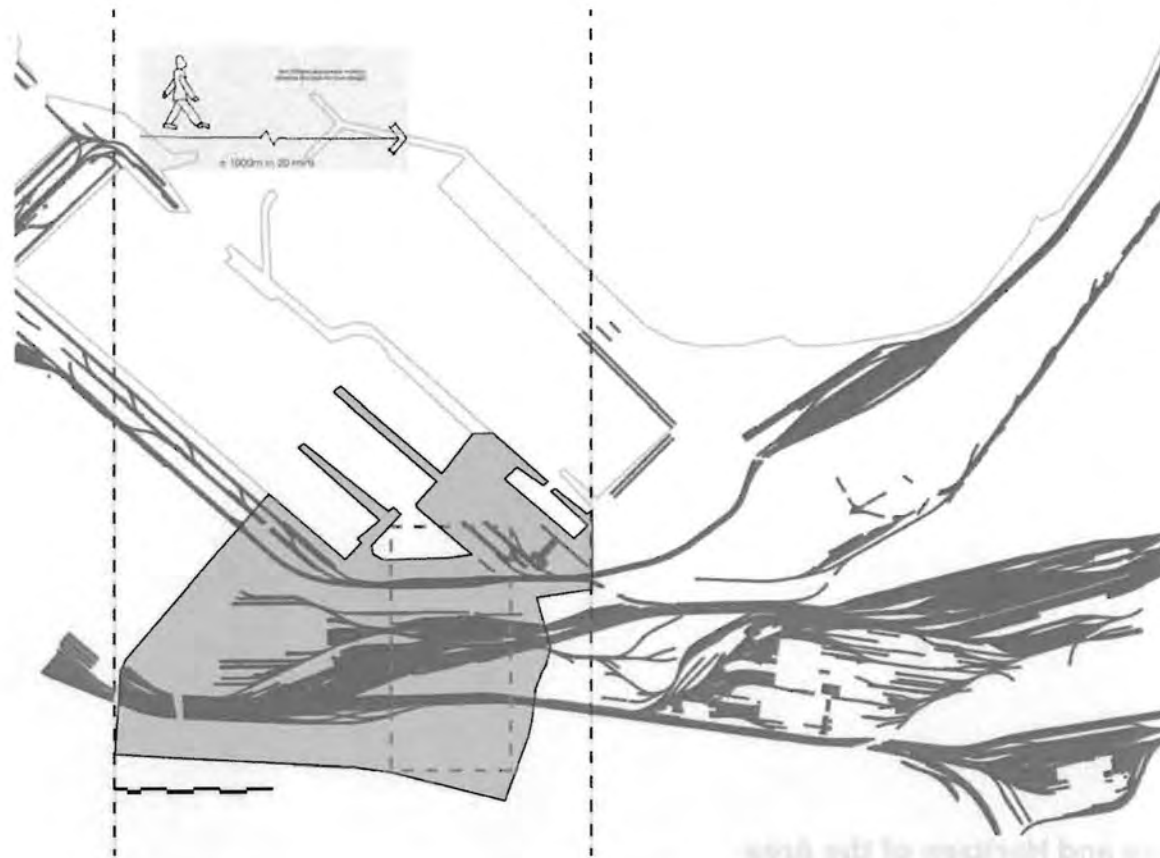
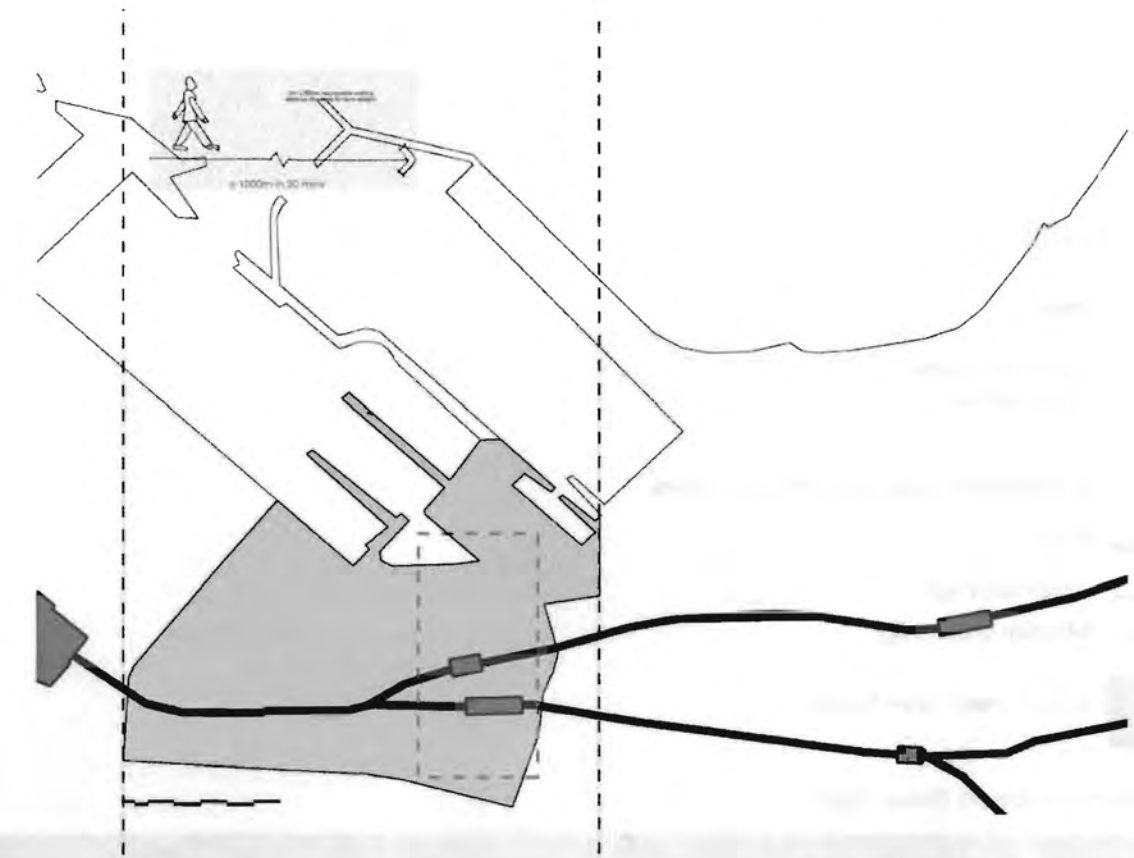


Figure 25: Railway Lines and stations



Pedestrian Bridge corridor





Figure 26: Road Network highlighting main barriers in the N1 and Eastern Boulevard Freeways

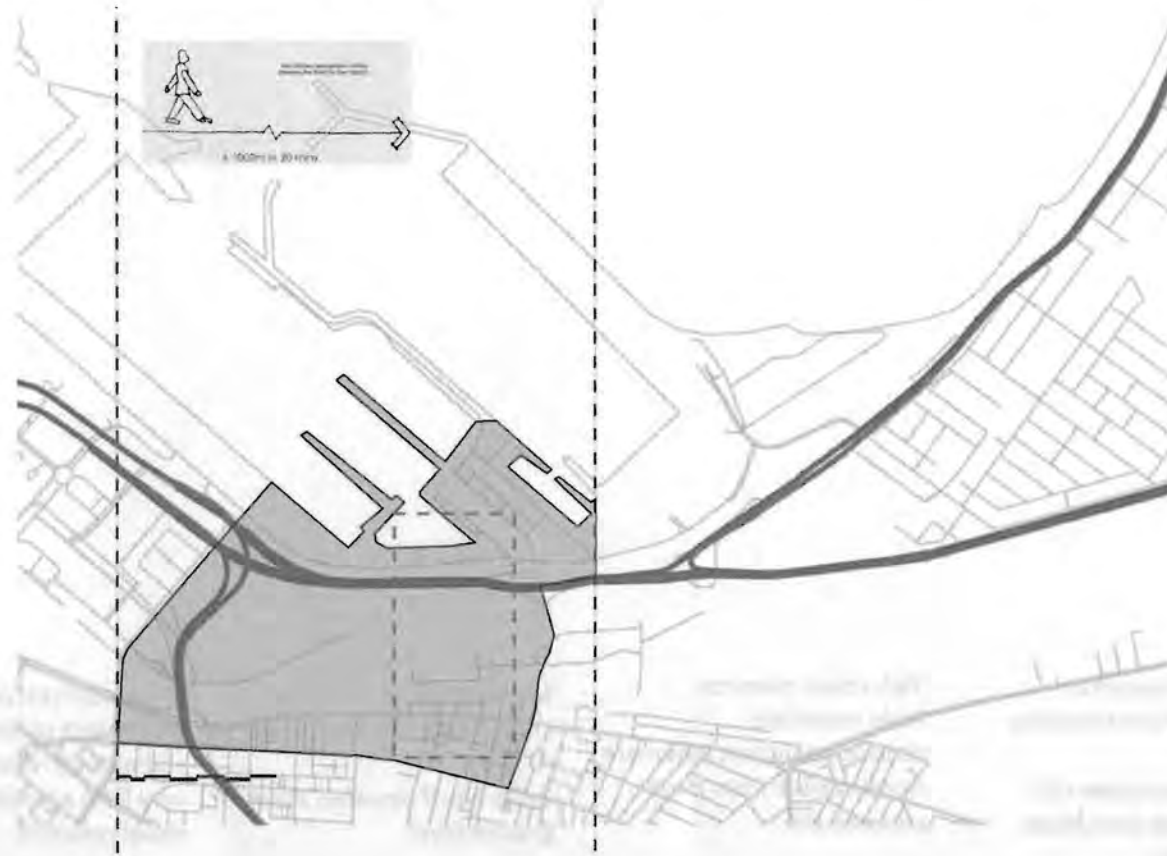
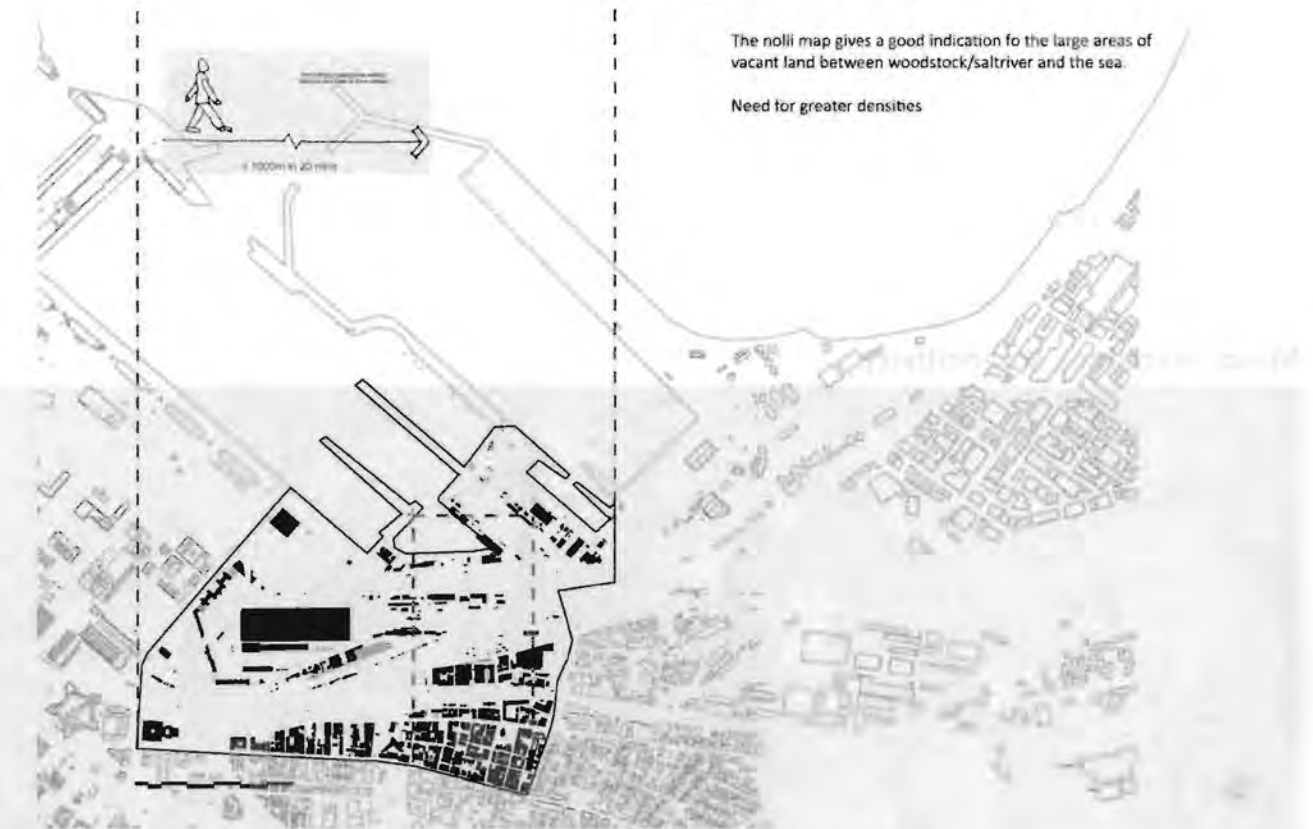


Figure 27: Illustrating road and rail barriers combined



Figure 28: Figure Ground Illustrating the open and desolate area of Culemborg



The noli map gives a good indication for the large areas of vacant land between woodstock/saltriver and the sea.  
Need for greater densities

### Transportation infrastructure: Spatial barriers & urban dis-locators

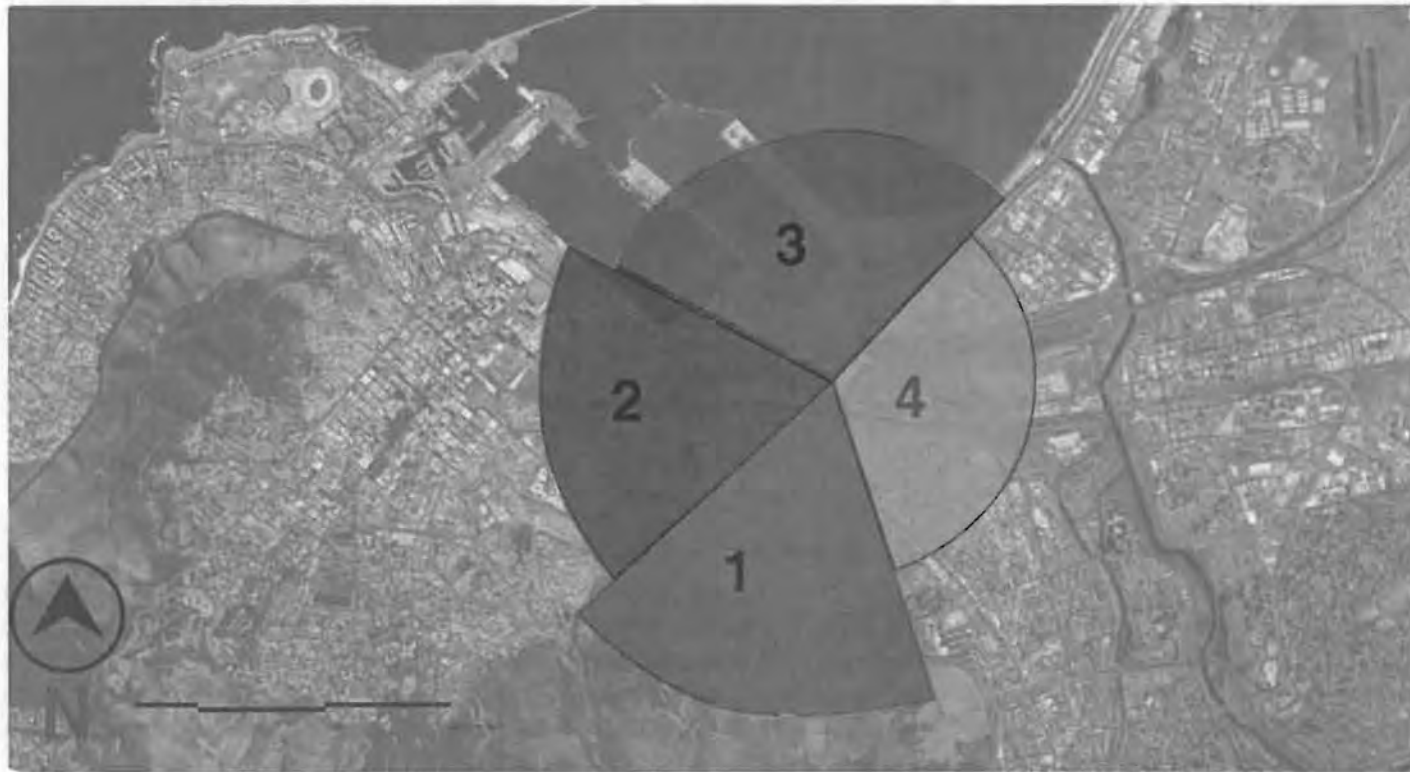
Transportation barriers are the main cause for the lack of access and integration in and around the Cape Town CBD. This was a concern that was expressed in the early conceptual drawings for the design process. These movement systems present large expanses of hard surfaced areas that accommodate fast moving vehicle transportation. Pedestrians can only cross at dedicated crossings. The freeways of Table Bay Boulevard, Voortrekker Road corridor, Black River parkway, Liesbeek Parkway, the Eastern Boulevard, Main road/M4 corridor and the N1 freeway are all responsible for the disruption in pedestrian access and movement within this area.

Culemborg itself is characterized mainly by the use of railway services, operated and owned by Transnet. These large expanses of land are covered by railway lines some in use, some no longer in use. Large areas of the site are still covered by the remnants of old railway corridors no longer in operation. These lines serve as a barrier to development as these solid infrastructural material make it impossible to use the land. The railway also acts as urban dis-locators and causing barriers for pedestrians to freely move through the site. Future development proposals of the City of Cape Town have been to drop the railway lines underground freeing the space for further housing development. However this may never happen or it may take many years for such a huge operation to take place. Therefore it is proposal of this these to bridge these immovable barriers thereby helping to continue the pedestrian movement through the site and to reconnect the city with the sea. If and when the railway do go underground the bridges can partly serves a structuring elements within the future urban plans.

- N1 and Eastern Boulevard Freeways
- Albert Road
- Railway lines



### Visual resources & sensitivity



High visual resource.  
Devils Peak and Mowbray  
Ridge  
Dramatic mountain vies  
clearly visible from most  
areas on site.

High visual resource  
Table mountain  
Historic and iconic landmark  
clearly visible from most  
areas on site

Medium visual resource  
Lions Head and Signal Hill.  
Table Bay if elevated above  
ground level

Low visual resource  
Due to lack of elevation  
and natural resources,  
very little accounts for  
visual resource

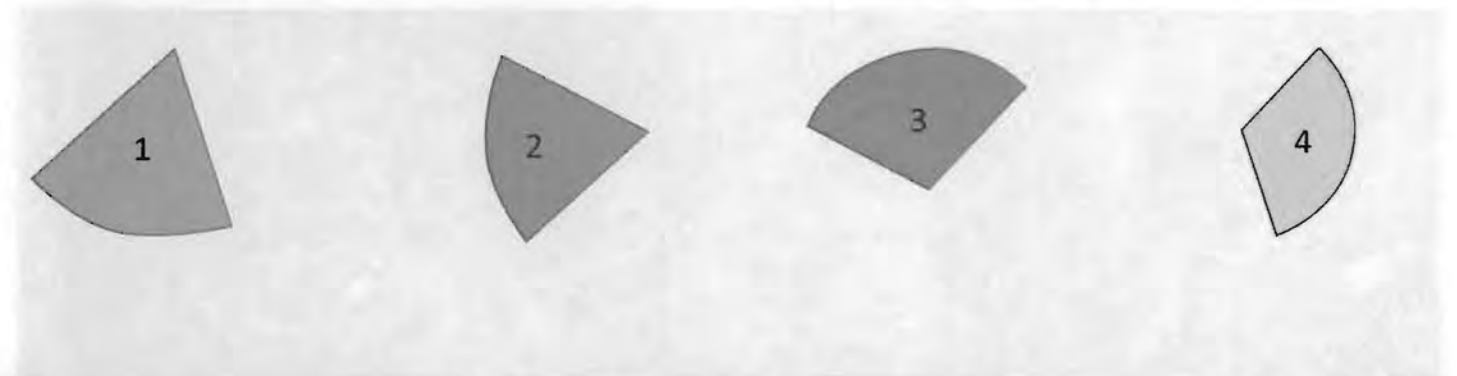
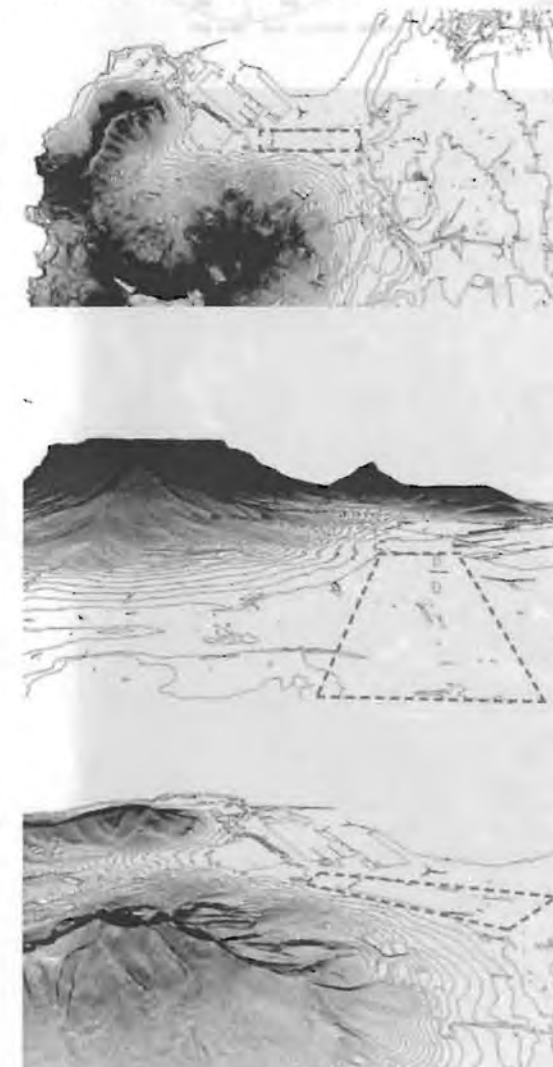




Figure 29 Cape Town natural water systems in relation to the Culemborg Site



Figure 30: Topographical study of site contours in relation to the City Bowl



Gideon Roos, 2009

### Ridge Lines

Valley

### Rain Water Down Flow

Storm Water Run- off

Hard surface: Neighbourhoods

## Highways

Car parks

Concrete & tar surfaces

### Built roof structures

Culemborg site: Collect storm water runoff from Upper Woodstock, Walmer Estate, Lower Woodstock, Salt River



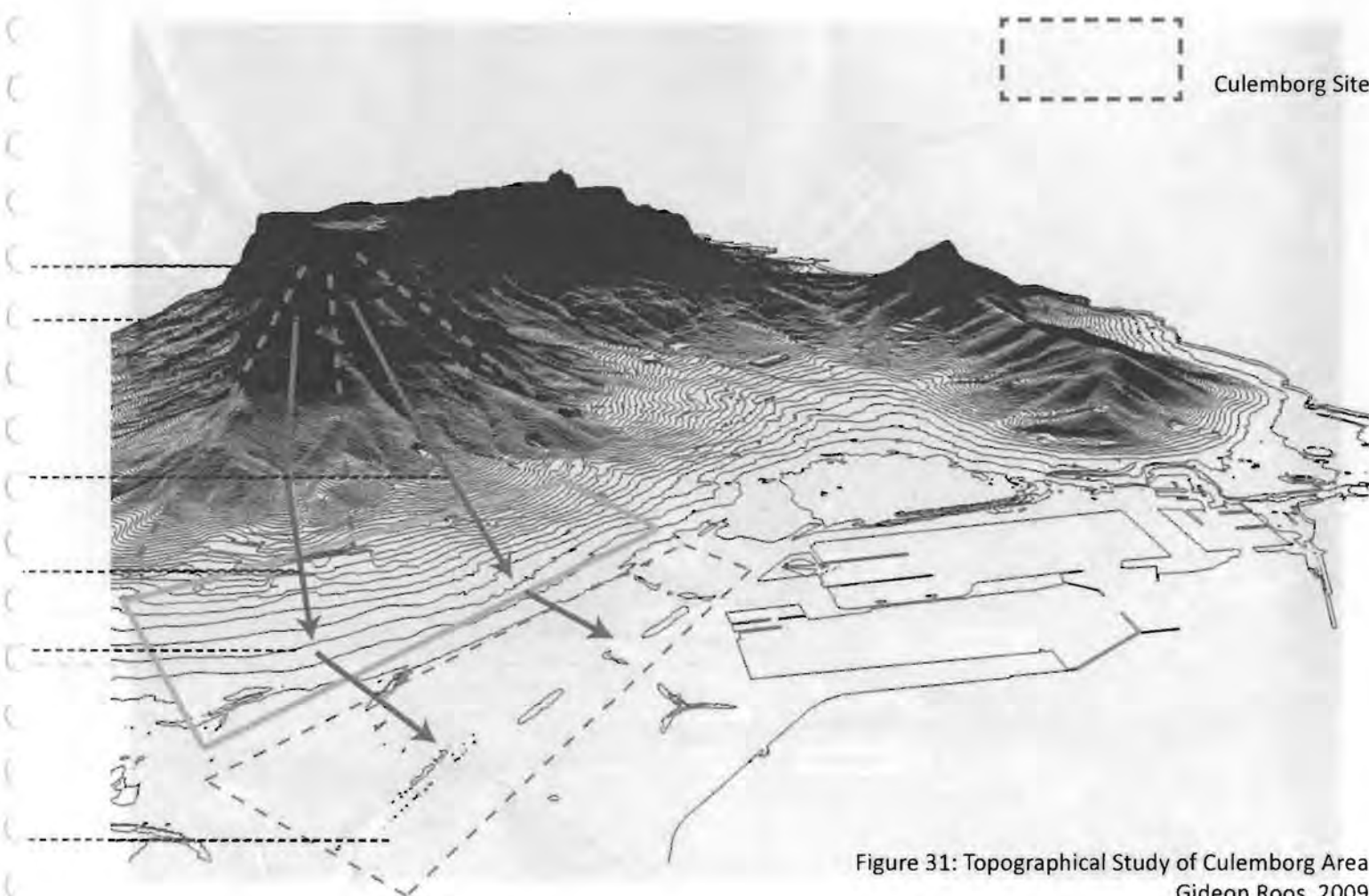


Figure 31: Topographical Study of Culemborg Area  
Gideon Roos, 2009

#### Typography of the site

In the figures alongside clearly illustrate that the location and topographical make up of the Culemborg area makes it perfectly suited to act as a natural buffer and soak away zone for the high urban storm water illustrated in figure 31. The site itself is generally flat site lying just 3.9m above sea level at the highest point and only 1.7 in others (Harbour view, 2000). The water table lies between 1.3 and 2.2 meters below ground level. There is a storm water culvert that runs under the entire site. The capacity has been tested in different calculations but its dimensions probably aren't sufficient to drain the storm water from the site (Burl, Nigel). Storm water however is an issue that needs to be solved in order to prevent flooding. This further justifies the idea of creating a natural buffer or wetland corridor that is able to distribute and soak up the storm water.

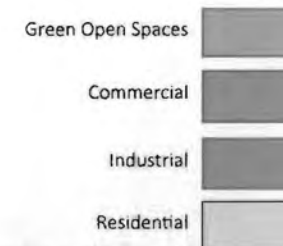


Figure 32: Land Use, greater Culemborg Site



**FIGURE GROUND STUDY  
ZONING**

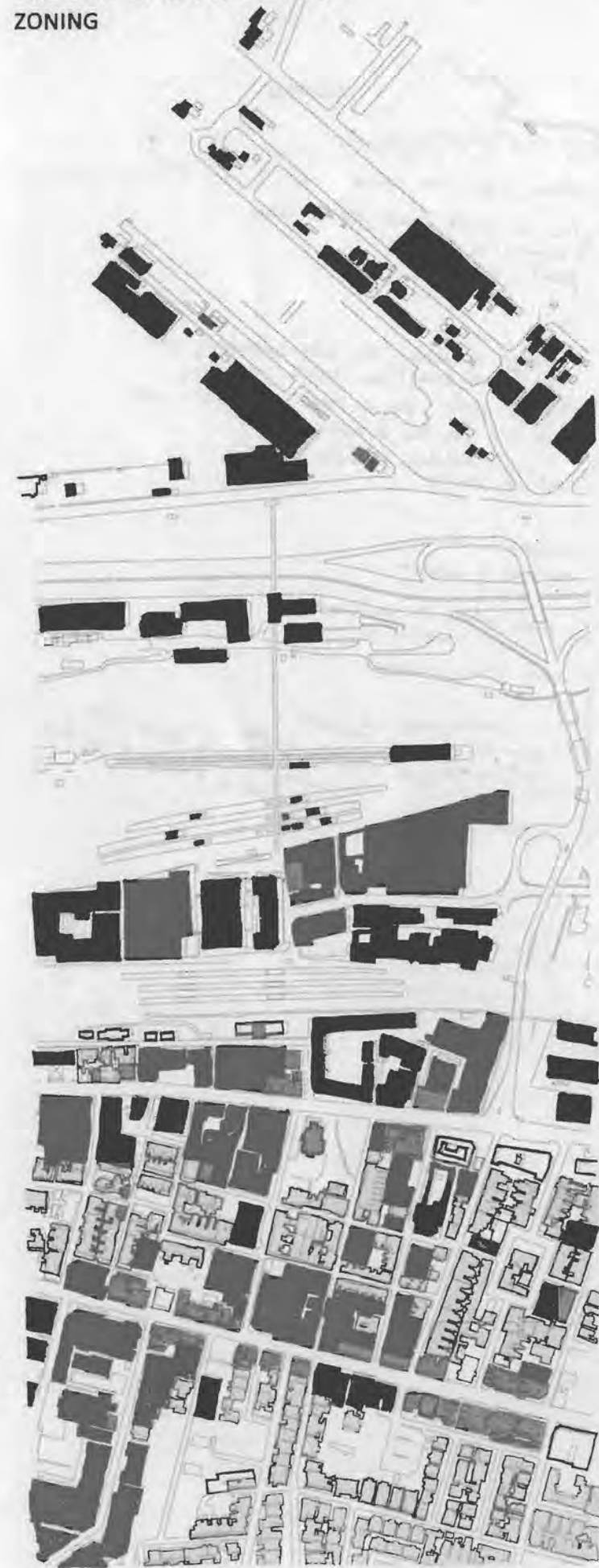


Figure 33: Land Use, use a focus on pedestrian bridge corridor

**BOUNDARIES & BARRIERS**

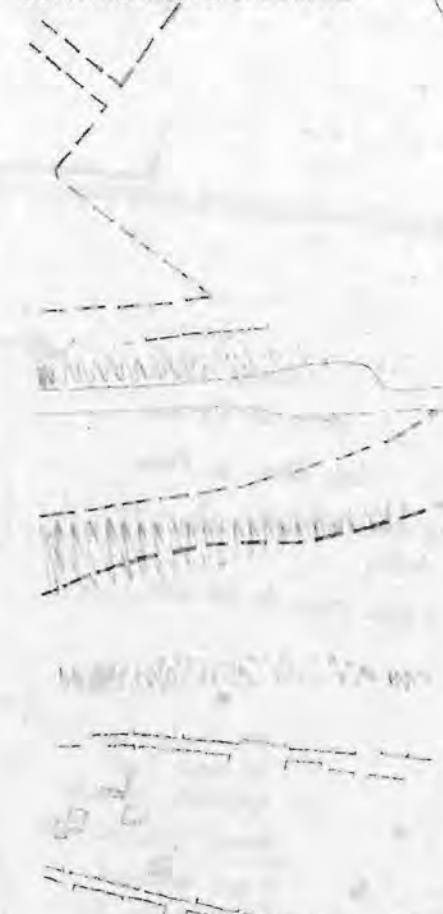
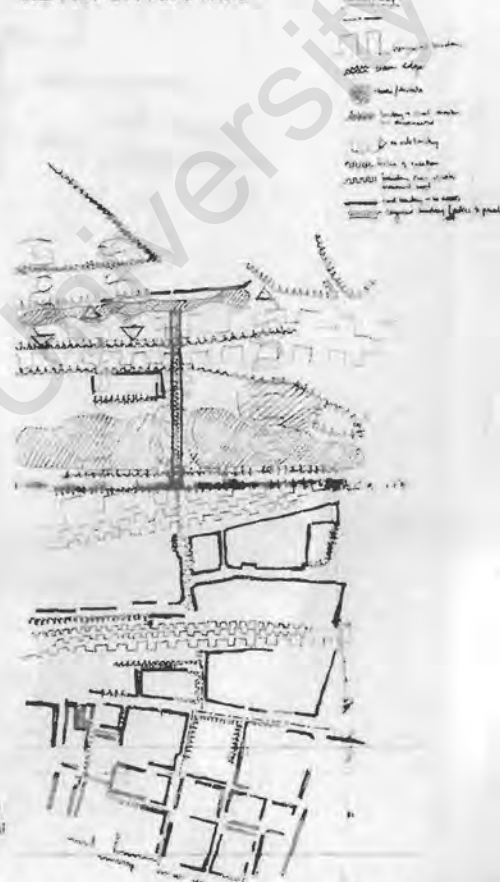


Figure 35, Barriers and Boundaries:

Figure 34: Kevin Lynch Map

**KEVIN LYNCH MAP**



### Land Use

Culemborg is currently used for services related to railway and logistics under the use of the South African Rail Commuter Corporations and Transnet. The urban fabric of the area reveals railway warehouses and storage comprising of unused railway tracks and structures. The strategic location of the site however makes it best utilized as a form of intensive mixed use zoning.

The drawings alongside illustrate a layering of the land use from a scientific analysis separating, industrial, residential and commercial land, from a scale of the greater Culemborg site (figure 32) and at a scale more focused on the bridge corridor (Figure 33). However this approach illustrated alongside needed another layer of investigation in order to better understand the journey from woodstock to the harbour. Therefore following the land use drawing in figure 33 the design approach was to discover the qualitative elements of the mix of residential, industrial and commercial functions, which made up the Woodstock urban fabric. This was done by means of a series of sections seen in figures 37-40. These sections were then supported by a section through the existing pedestrian bridge (figure 36), illustrating the journey from Albert Road Woodstock over the railway line of Woodstock and esplanade stations continuing over the new BRT Station, over the Culemborg site, the N1 freeway and finally landing in the harbour. The section was then also divided into various zones that from a personal perspective had a variety of experiences along its journey.



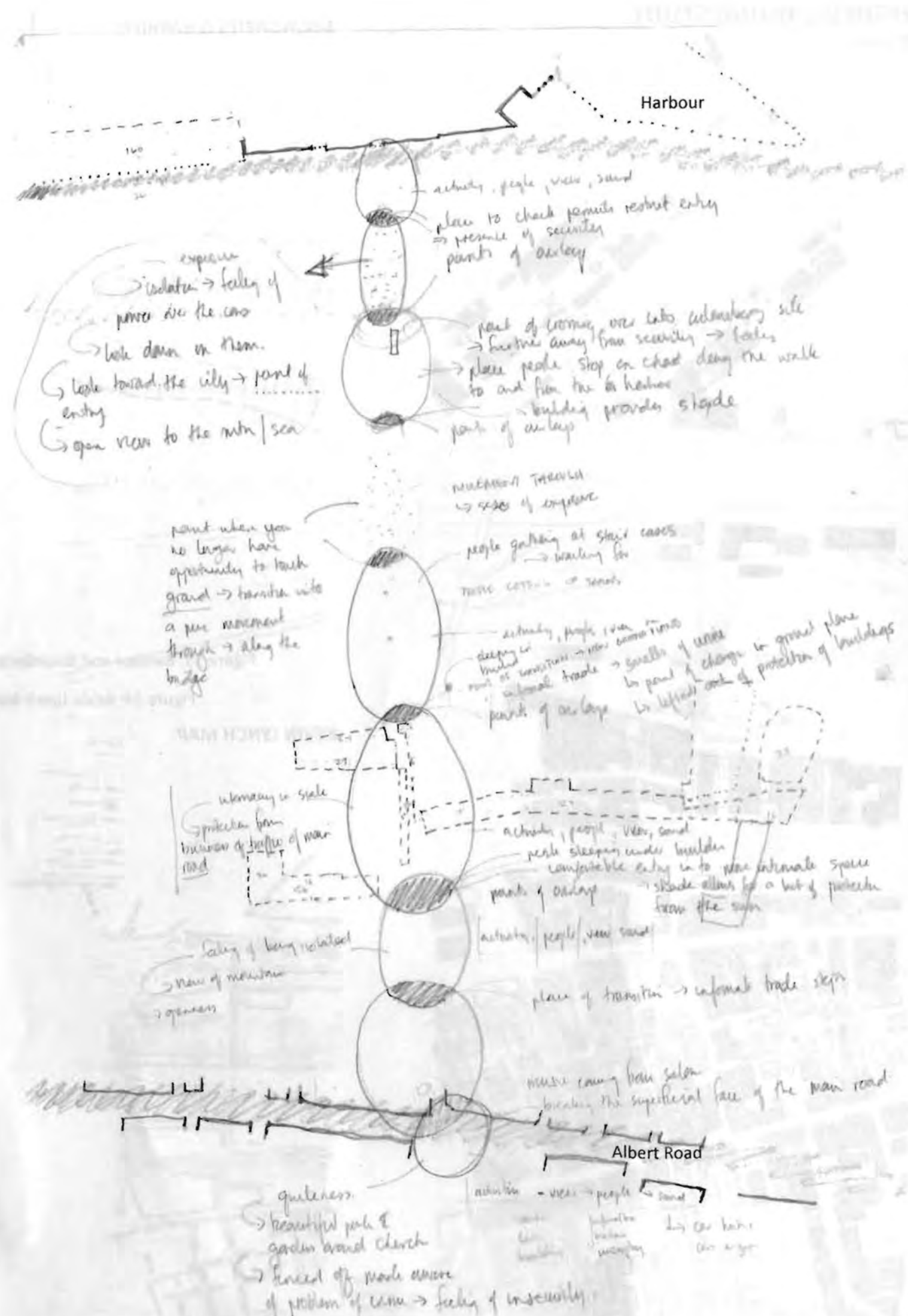


Figure 36:  
Mapping drawing illustrating the  
different zones experienced when  
walking the distance from wood-  
stock to the harbour.

These zones are also represented  
in the existing bridge section



#### ZONE ONE

In front of the shops on Albert Road there is a series of public squares. The shops are on the main road. The street around the shops is a quiet street. It is a quiet street. It is a quiet street.

#### ZONE TWO

The beginning of the journey to the station from Albert Road. The shops are on the main road. The street around the shops is a quiet street. It is a quiet street. It is a quiet street.

#### ZONE THREE

The shops are on the main road. The street around the shops is a quiet street. It is a quiet street. It is a quiet street.

#### ZONE FOUR

There is a quiet street. It is a quiet street. It is a quiet street.

#### ZONE FIVE

There is a greater gathering of people in this area. They are waiting for their train to arrive or they have just arrived. These people then go either towards the station or towards the shops.

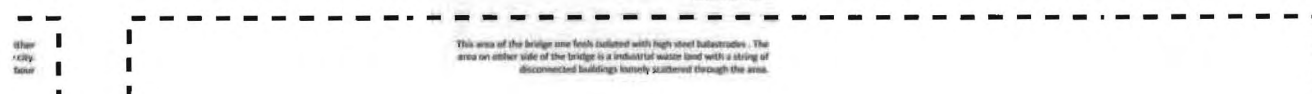


Station





#### ZONE SIX



This area of the bridge one feels isolated with high steel balustrade. The area on either side of the bridge is a industrial waste land with a string of disconnected buildings barely scattered through the area.

#### ZONE SEVEN



Elevated above the N1 highway, creates a feeling of exposure but also a sense of empowerment over the motor car. The bridge has spectacular views of the mountain, the city and the sea.

#### ZONE EIGHT



This point in the harbour is a chaotic area with trucks constantly moving up and down. The sound of grinding, cutting, welding etc are all very evident. The smell of urine and a feeling of being unwelcomed. It is a place built for the machines. The pedestrian is expected and a constant warning for safety.

This is also the point of arrival for the hundreds of people working on the docks and for those caring in search of a meal. Many of these people sit on the dirt and wind, and rain in the hope of finding work. There is no public amenities which means that the side of the road becomes the toilet.



Bicycle and Pedestrian Route

SRT Station

N1 into the City

N1 out of the City

Security Kiosk at the Harbour Edge

RCD Dockyard



University of Cape Town



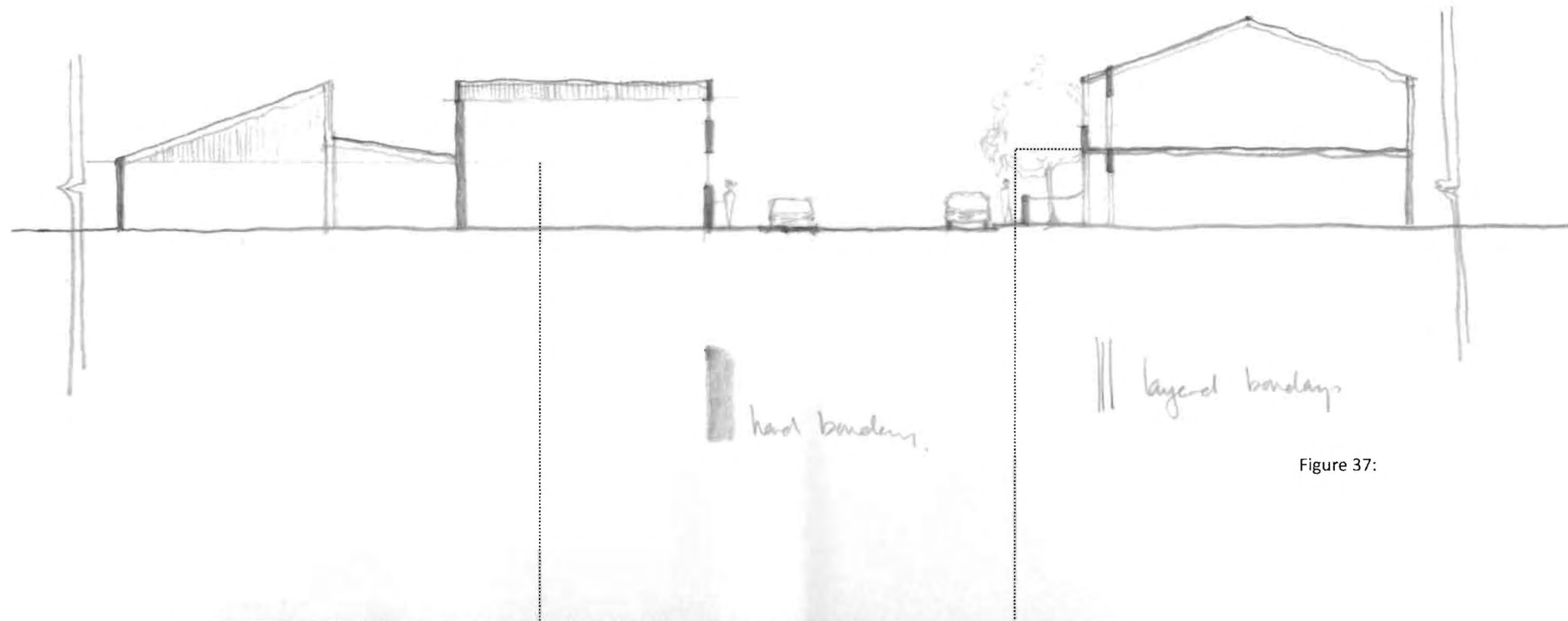


Figure 37:



People squatting on vacant areas of land, making shacks out of available material from the area. In this case the shacks have been built up against an existing house, using predominately timber which is a clear indication of its availability amongst the poorest of the poor.

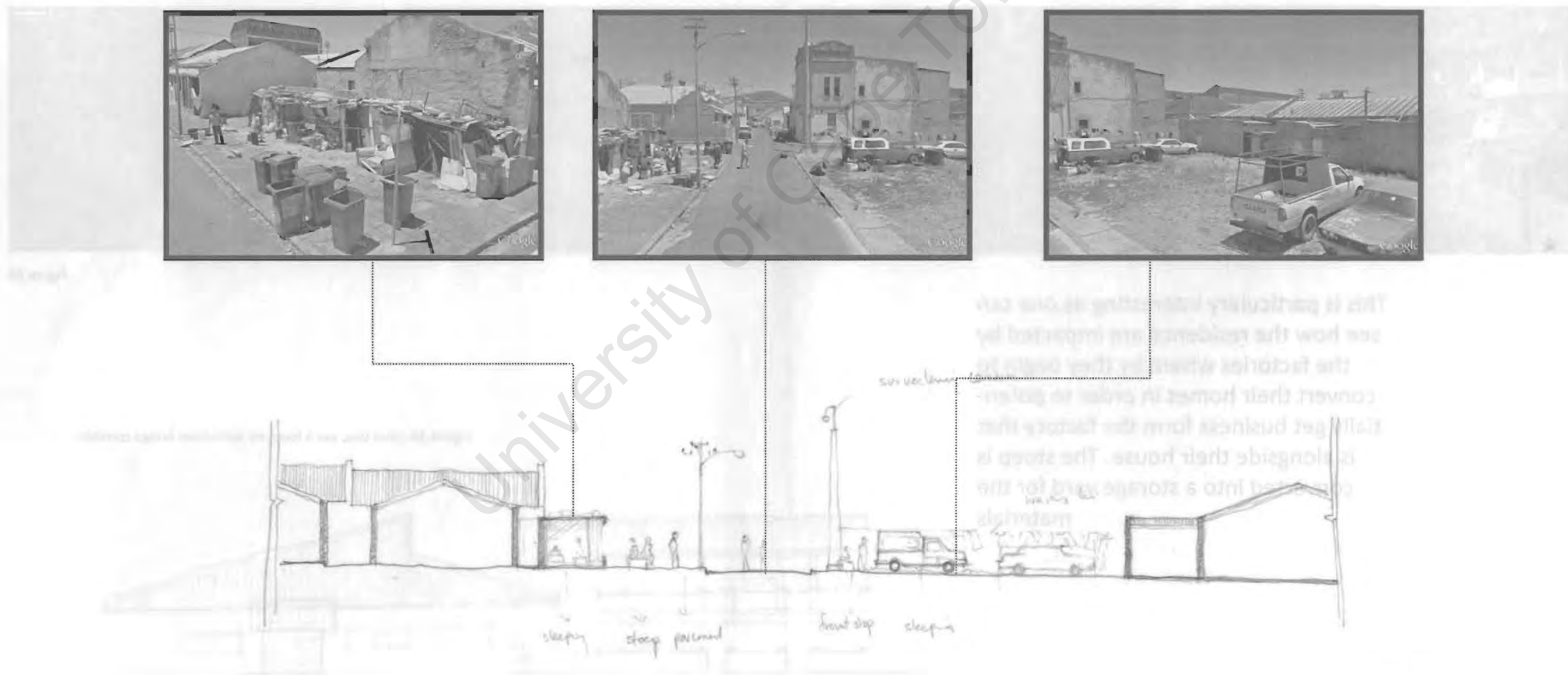


Figure 38

People are using the space of land, making it a place of business. In this case the shops have been built up against the existing houses, using the existing infrastructure to support the business of the shops.



Figure 39

This is particularly interesting as one can see how the residence are impacted by the factories where by they begin to convert their homes in order to potentially get business from the factory that is alongside their house. The stoep is converted into a storage yard for the materials

Figure 33: Land Use, use a focus on pedestrian bridge corridor







Figure 40

This elevation of William Street in Woodstock shows the diversity and complexity of the built fabric. There are residential houses directly adjacent to factories with a tremendous variation of scale and street edge. In the Lynch map the resulting street edge condition of this diversity becomes more apparent.

It is this complexity and diversity in function and form that is appealing and difficult to capture in a new architectural proposal.





Figure 41  
Floor structure for  
the modification of  
a ship.  
(Role of Ship Repair, Cape Town Port. pdf)

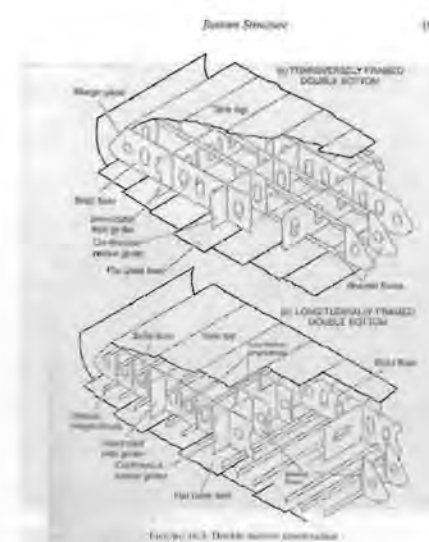


Figure 42  
Double bottom floor  
structure  
(Eyres: 164)

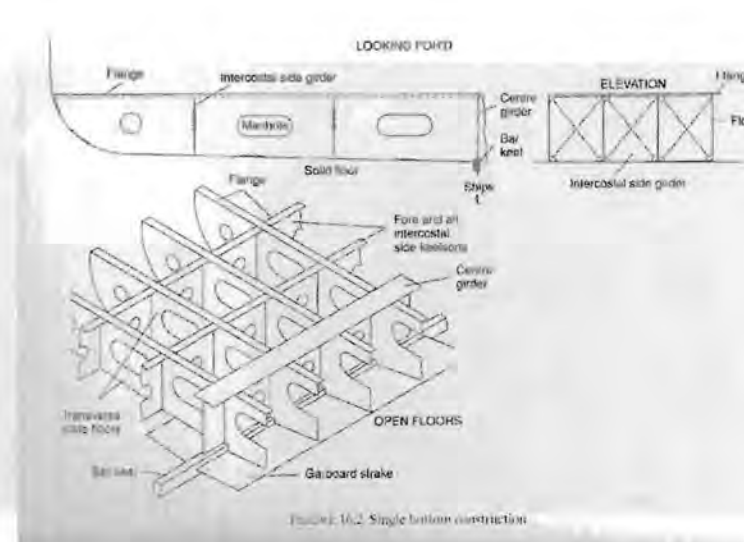


Figure 43  
Single bottom floor  
structure  
(Eyres: 165)

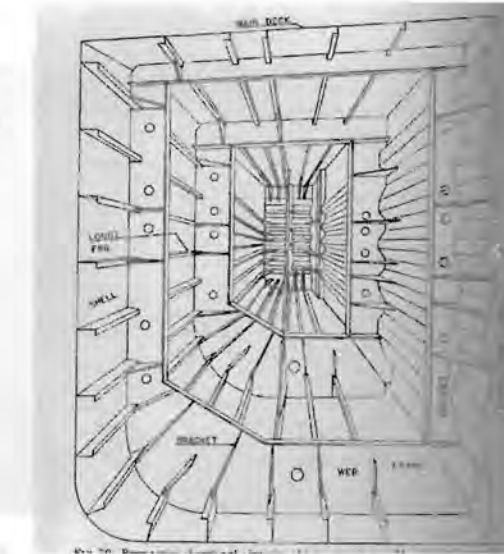


Figure 44  
Ship Framing System  
(Eyres: 177)

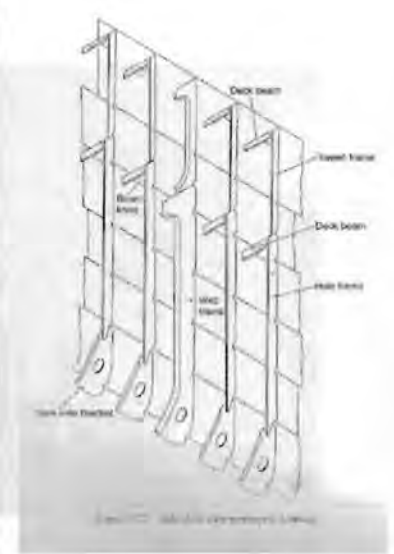


Figure 45  
Side Shell plating with  
transverse frame

## section 4

### TECHNOLOGY RESEARCH SUMMARY

The building technology looked at prefabrication with a focus on ship construction materials and assembly techniques. As mentioned above the design vision has been directed by an investigation into the physical and social attributes of the site that has offered opportunity to explore these technological design approaches. Furthermore the industrial nature of the site and its surrounds lends it-self to a building of industry. The challenge is however not to simply make an industrial building, but a building that is site specific drawing from the social and physical attributes of the site. Prefabrication or any other industrial production, however, carries with it, the fear that the project will lose its individuality and specificity to local sites and cultural conditions. It is important that the design technology finds a balance of site specific responses combined with the prefabricated industrialized components of the construction systems.

Through the materiality and making the project intends to assist with regard to the social conditions of the selected site. The design vision therefore is that through the materiality and making of this building, those that already have skills in the area of welding, sand blasting, grinding etc, will be pushed to further their skill base and for those without skills will, through an apprenticeship program, be able to learn skills that may give them opportunity on the harbour but also opportunity in other areas of manufacture and building elsewhere in the city.

The initial investigations into the site and the surrounding area carried out above have presented a clear impression of the robust nature of the structures in the area but also a better understanding of the people using the structures. The commonly used material in this context is steel and is seen in the industrial buildings as well as in the construction and ship repair in the harbour docks. Therefore there is a design approach to address the application of this material in the building technology, both in primary structure and building envelope.

However, ship construction and repair offers great potential in sustainable skill development and job creation. Therefore part of the technological investigation is to understand the principles of ship construction and assembly techniques. This is in order to use the materials that are familiar in this industry, such as steel and sheet metal, and apply it in a system of pre-fabrication that allows for the simply assembly of the buildings parts.

The technical component of the design exploration followed a sequence that included investigations into steel ship construction, which developed into research of metal surfaces in architecture and finally looking at the work of Jean Prouve, who helped demonstrate how sheet metal can be manipulated to form simple yet sophisticated prefabricate panels that are easily assembled on site.



(Role of Ship Repair, Cape Town Port. pdf)  
Figure 46  
Side Shell plating



(Role of Ship Repair, Cape Town Port. pdf)

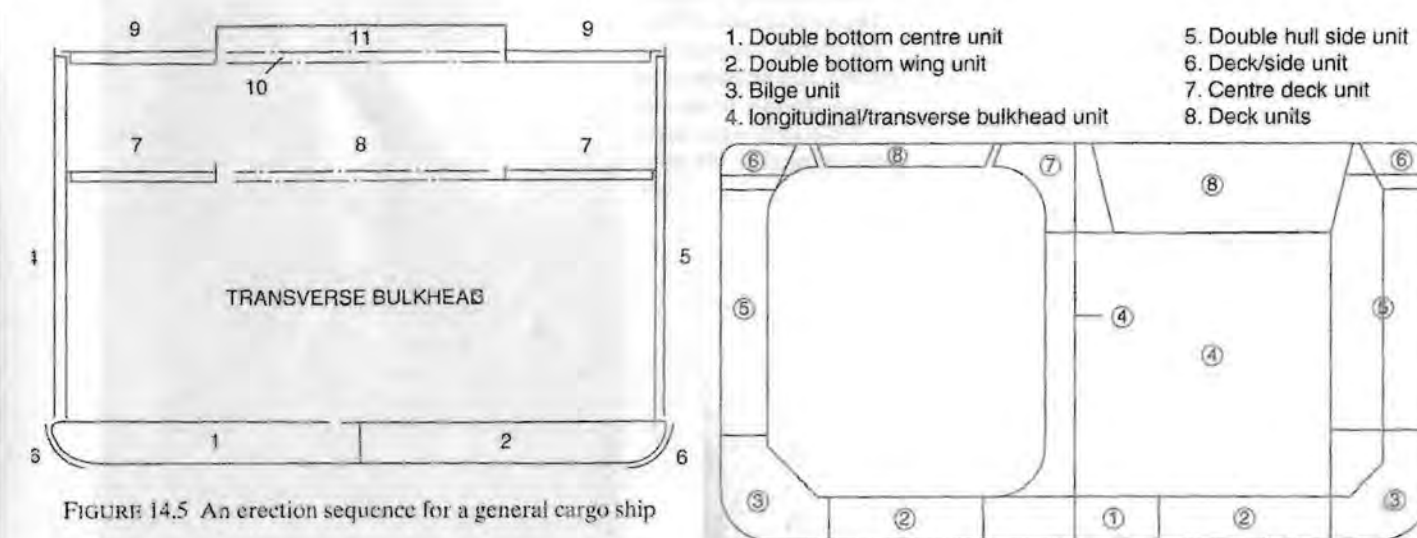


FIGURE 14.5 An erection sequence for a general cargo ship

Figure 47  
Erection sequence for ship  
construction

### Ship Building Materials

There is a wide range of ship construction material ranging from timber to fibre glass to steel, aluminium, and ferro-cement. Steel is usually used for the larger ship construction and is a material that is commonly used on the harbour and surrounding industrial context of the site. The materials of interest therefore are steel and sheet metal, due to the robust and machine-like qualities coupled with its common application around the surrounding area.

### Ship construction: Steel framing systems

In the transverse systems of framing the closely spaced principal frames run transversely inside the shell. These transverse frames are further supported by side stringers, bottom longitudinal and other widely spaced auxiliary longitudinal framing (Baker, 77) (figure 44). The transverse frames are spaced at 2 (600mm) to 3ft (900mm) on merchant ships and 4ft (1200mm) on naval vessels. The changing distance of the frame spacing has direct impact on the thickness of the plating welded to the frames (Baker: 78). Furthermore, in respect to building this will be investigated in the application of metal surfaces in architecture.

### Shell Plating

The skin of the ship is more than just a protection from the external elements, but plays an important part in unifying the box girder structure of the ship. The metal skin of a ship is made up of a shell that is composed of steel plates, most of which are rectangular in shape (figure 46). They are arranged in a longitudinal manner on the ship and when in place one after the other, are known as a course or strake, of plating. The thickness of these plates varies according to the size of the ship and the location of the plate (Eyres : 175). As mentioned above, the steel framing of the ship forms a regular rhythm of steel blades that gives the skin its thickness and thus its strength (figure 45-46). This thickness when applied in architecture skin of the building can be used to express and articulate a building as it responds to different weather conditions as well as different social functions. Shell plating consists of a series of flat and curved steel plates generally of greater length than breadth, butt welded together.

### Metal Surfaces in Architecture

This has led to an investigation of the application of metal surfaces in architecture. Firstly steel, the material of choice, is considered a utilitarian material, better used as a skeleton hidden from view by the beauty of another material. Steel does have the potential to be a very intriguing surfacing material. Its colour is greenish blue to blue grey; its surface can be pol-



Figure 53  
These show the variation in depth of the grill, connection, adding relative strenght to the facade.

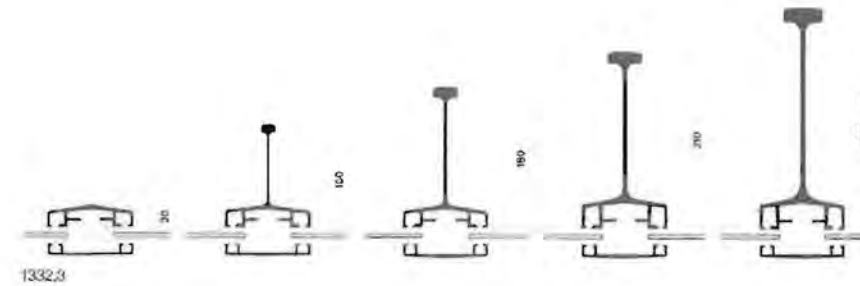


Figure 48  
Private Residence. Designer Marlon Blackwell Architects. Vertical Running bond pattern used on weathering steel shingles. Image was taken six to eight weeks after exposure to the ambient.



Figure 54



Figure 55

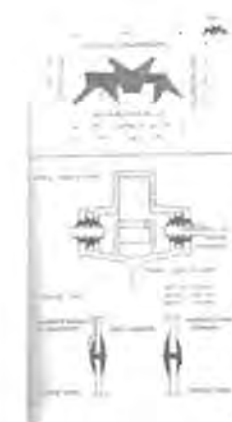
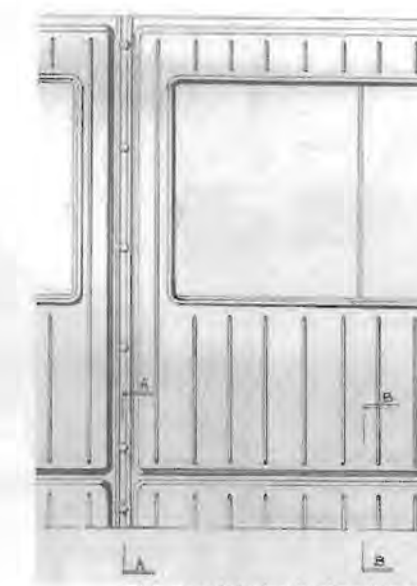


Figure 56  
These images illustrate the components needed for a grill type curtain wall.



Figure 49  
Jean Prouve Industrialised Panels



This panel design is aimed to reduce tooling and manufacturing costs.

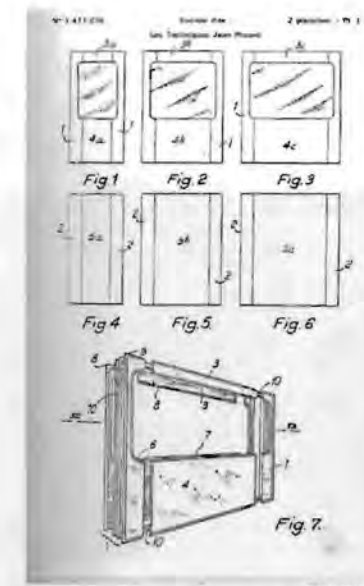


Figure 51

ished, oiled, stained and enhanced in ways many other metals can only try to duplicate. Steel possesses unique colour and surface characteristics that bring a feeling of strength and substance. Its greatest problem to overcome is its ever-changing, ever deteriorating nature. However on the contrary as opposed to fighting the change, embrace it, as the site itself and people using it are constantly changing. This then brings the idea of using weathering steel that is a steel alloy that contains copper. This alloy develops a red iron oxide in the presence of moisture. Eventually, the oxide coating becomes very dense and hard, developed slowly over time by the joining of oxygen from the air to form the hard mineral hematite (Zahner, 2005: 44). In these two 'types' of steel sheet metal there are other opportunities to explore in terms of a outer skin that weathers with time and an inner skin that reflects a sense of newness and holds the building structure together. Figure 48 is an illustration of the colouring effect of the weather steel sheet metal. The colouring and texture of the material makes reference to the steel inside the ship's hull.

#### The limitations posed by machine required fabrication of sheet metal: Technical limitations of Fabrication and Handling Process

Folding Press Brake	3.5m length
Curving Plate Rolls	3.5m length
Punching, performing Turret	1.25m width
Shearing Power shear	3.5m length
Cutting-plasma Plasma table	3.5m length
Cutting-laser Laser table	1.25m width

#### These should also be seen with the limitations in terms of Steel Sheeting available widths:

Standard and maximum widths in mm  
Min 600 900 1200 1500 1800 2400 3000 Max

#### Jean Prouve: Prefab Visionary

Prefabrication was then investigated through the lens of the work of Jean Prouve who's work explored the use of thin metal sheeting as the right technology for achieving lightweight, dynamic and inexpensive architecture. The problem of light cladding was always central to Prouve's work and is demonstrated in his numerous facade panel patents (Picchi, F. 1998).

Traditional panels were conceived essentially as elements carried by a structure made of trusses, girders, columns etc. Instead Prouve's intended to establish a construction whole in which the voiles, ribbed sheet metal membranes, constitute an extremely light, self supporting whole (Picchi, F. 1998).

#### Jean Prouve industrialized panels.

Panel Principle for the light CIMT facade, namely the Jean Prouve industrialized panels system, consisted of large sandwich panels, either solid or with a bay that had sliding sash windows. The faces system made it possible for either a continuous faced panelling between the floors, or a curtain facade that is continuous in all directions (figure 49).

The panel materials were A5 Aluminium sheet, galvabande sheet, channel section in galvanized mild steel. The opening sashes were AGS aluminium, drawn neoprene sections, polyurethane foam of 14kg.m2 density. Connection sections were of galvanized Cor Ten steel. Apron flashing of stainless steel. Fixture components of galvanized mild steel. The components for the system of full panels were large sandwich panels the width of which varies from 120 to 330cm, in multiples of 30 and their height is 241 cm for those fitted as facade panels and 269 cm for those fitted as curtain facade. The bay panels were generally of an identical design to that of the full panels, but are pierced by a bay. The width of the components varies from 120cm to 330cm, in multiples of 30 and their height is 241 cm for those as facade panels and 269 cm for those fitted as curtain facade.

Figure 57  
Vertical section, illustrating how the panels are connected to each other and the primary structural elements

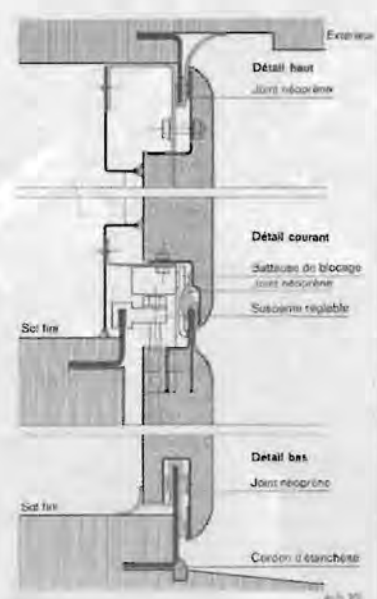
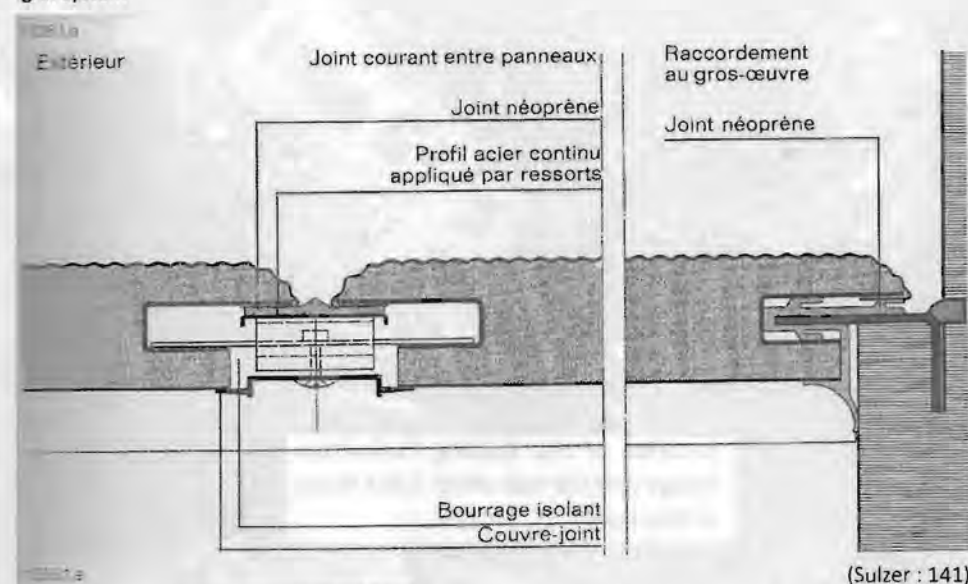


Figure 58  
Plan of the connection of the two panels. The joint is more subtle and without the extending aluminium 'blade, of the grill system



Pinciples of Contemporary Sandwich panels. Connections of these panels, remain the most difficult challenge

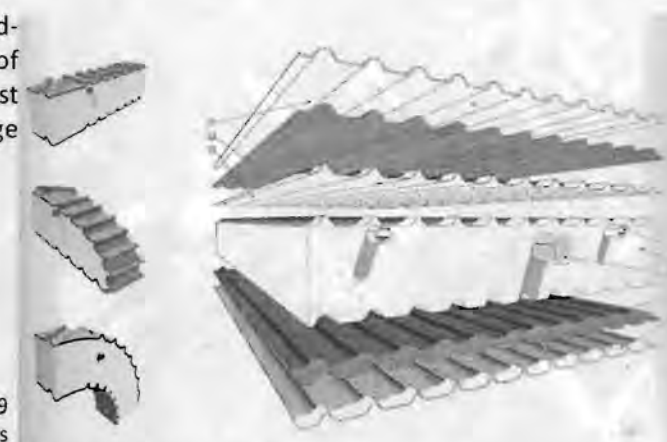


Figure 59  
SIP (Structural Insulated Panels)  
Anderson & Anderson :149)

Development of the above sandwich panels in seen in the figure (50-51), which offers a greater flexibility in its application. As mentioned in the prefabrication of the ship frame construction (figure 44), Jean Prouve has in a sense presented a similar system in the form of his sheet metal panels. Prouve uses panels made to measure thereby diminishing the real scope of the prefabrication. The panels are constructed by employing a standard portion, namely the side vertical member, which then compensate for the variations in the system by means of secondary elements (figure 51). This gives the pre-fabrication even greater flexibility. The latter are tailor made by simply cutting and bending the sheet metal on site (Picchi, F. 1998). For this reason as mentioned in the metal surfaces section of the report the thickness of the sheet metal should not exceed 0.6096 mm in steels and 0.4826 mm in stainless steel (Zahner, 2005: 44).

Alongside is a number of Prouve's connections for the insulated panels. Figures 54-56, show diagrammatically the wide variety of connections for the panels which are ultimately the most fundamental part of making these prefabricated systems work efficiently. The grille, illustrated in the figure 53 appears very similar to the blade like frames making up the strength and thickness of the ship's hull (see ship framing systems). The grille like the frame of the ship, performs very much the same function, by adding stiffness to the sheet metal, insulated panels and in so doing, Prouve's grille succeeded in making the light facade cladding independent of the buildings structure. As illustrated in the fig 53, the extruded aluminium stretcher consists in a long, shaped and partially hollow plate. It is long enough to efficiently act as a stiffening vertical member and sunshade (Picchi, F. 1998). The purpose of this research is to understand the principles of connection and sealing of the pre-fabricated panels. The principles as illustrated in the drawings above can then be used as a base on which to suit or respond to the needs of the design project. Figures 58 and 59 illustrated the connection details for panel to panel, panel to structure conditions.

Sandwich panels today (figure 59) similarly to Prouve, consist of a layer of encapsulated polystyrene or polyisocyanurate rigid foam and recycled agricultural fiber. The panels provide very high levels of insulation for their thickness and are relatively inexpensive. Most panels are based on the dimension so plywood sheets that make up their faces, they typically are

manufactured in 1.2m widths, with variable lengths up to a standard maximum of 7.3m. Other manufacturers make wider panels up to 1.8m or 2.4m widths. The thickness of the panels varies, but typically ranging from 10.16 to 30.48 cm (Anderson & Anderson: 148). The sandwich panels developed by Prouve and similarly in contemporary times are capable of being used as system on their own, or in conjunction with other purely structural systems such as timber frame or structural steel (Anderson & Anderson :149).

### Technology Conclusion

Through this research journey from ship construction to metal surfaces in architecture to prefabrication and the inventions of Jean Prouve, it has created a broad base of information from which to work in terms of creating a dynamic building that responds to both the technical requirements and the site specific conditions. These principles have demonstrated how sheet metal can be prefabricated in order to create a building that is efficient, dynamic and easily assemble while maintaining a character that is true to its context and building users.







# section 5

## DESIGN DEVELOPMENT

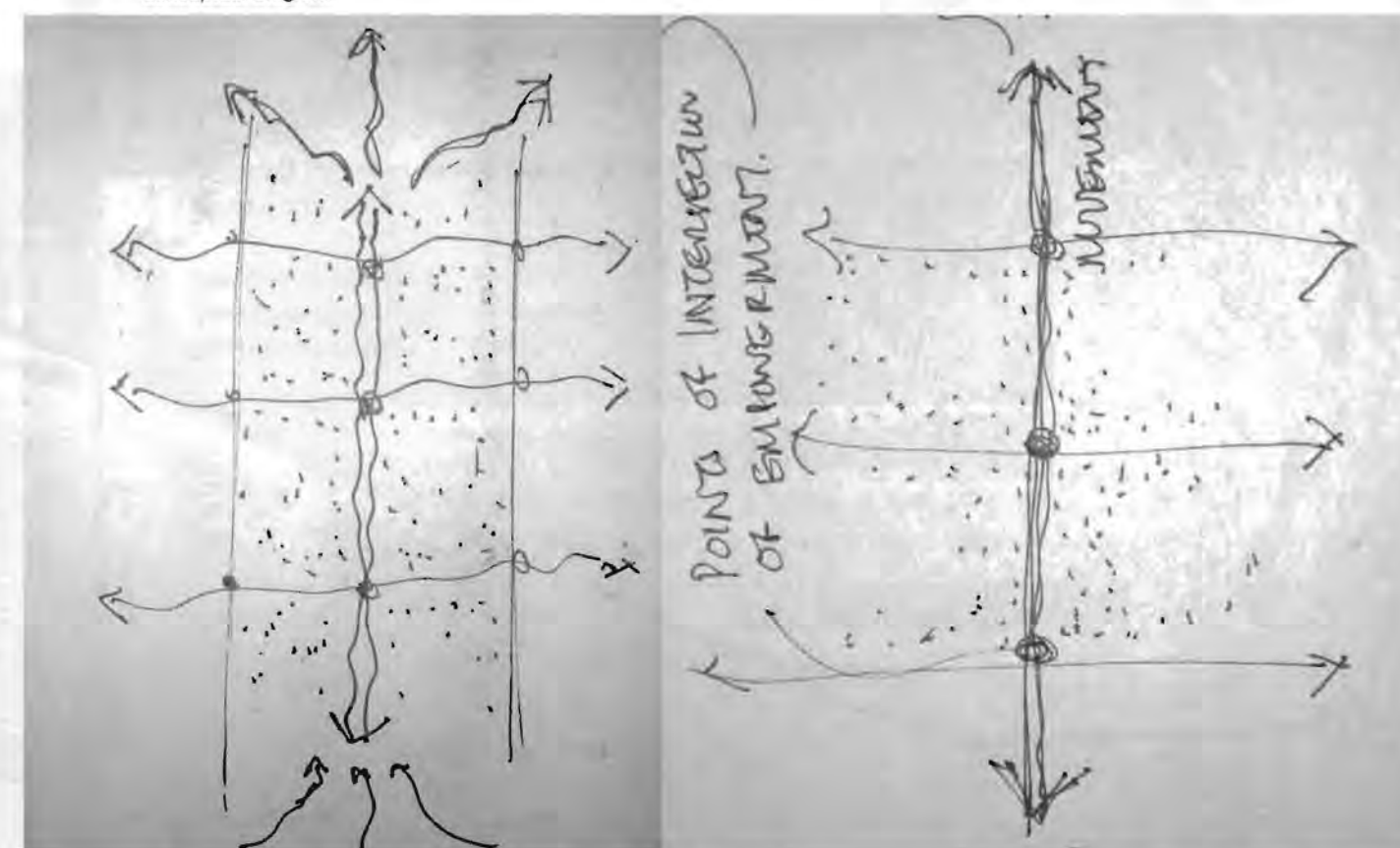
### Urban Strategy

The diagrams (figure 61) above were the first conceptual diagrams of the movement through the site that showed along its journey points of integration, that were imagined as points of activity, encouraging social encounter and delay along the movement route.

However from these first ideas the initial step in the design development was to set up an urban design strategy that was based in the research and findings carried out in the site analysis and theoretical components of the project. The linkage drawing illustrated alongside (figure 60) represents the chosen extensions of the existing urban fabric of woodstock that has set up the points at which the proposed bridges will begin to integrate the barrier of Culemborg. The development of these links into the proposed bridges is illustrated in figure 62. The urban design scheme has drawn inspiration from both the landscape with reference to the work of Gideon Roos's landscape architectural thesis for the development of Culemborg as well as the urban design proposal for the same area by Roelof Uytneboogaard.

These proposals couple with the investigations carried out in the woodstock area that established the incredible layering of residential, industrial and commercial elements of the urban fabric has influenced an idea of creating a system of horizontal

Figure 61  
Conceptual Diagram



layers that set up the mixture of the land use according to recreations (park/wetlands), residential and industrial. The intention is that the bridge building would be the linking element between all these different layers and at the points integration, social encounter and delay will be the points at which the bridge building touches the ground and begins respond to potential future development of the area.

The first layer is for the creation of a green corridor that will establish the east west link of city to river as illustrated in the ecological mappings of the site analysis (figure 23). This first layer runs adjacent to the recently completed BRT lane and pedestrian cycle track. The area will be a combination of wet land and recreational space acting as a "green" spine running through the centre of the proposed development. This spine has the potential to lead to new emerging ecologies and can also act as a natural buffer or soak away for high urban stormwater run-off (figure 31) (Roos, 2009).

The next layer is the residential layer, that will be comprised of a high density mixed use housing schemes, in order to make use of the strategically placed land. This housing scheme will be subject to spectacular views of the mountain and with easy access into the city.

Finally the last layer of the scheme is the industrial layer which has been set up along the N1 freeway. Its placement is also in relation to the main vehicle access road into the site thus allowing for the delivery of material and goods into what intends to be a vibrant and energeise industrial strip setting up the boundary edge of the development.



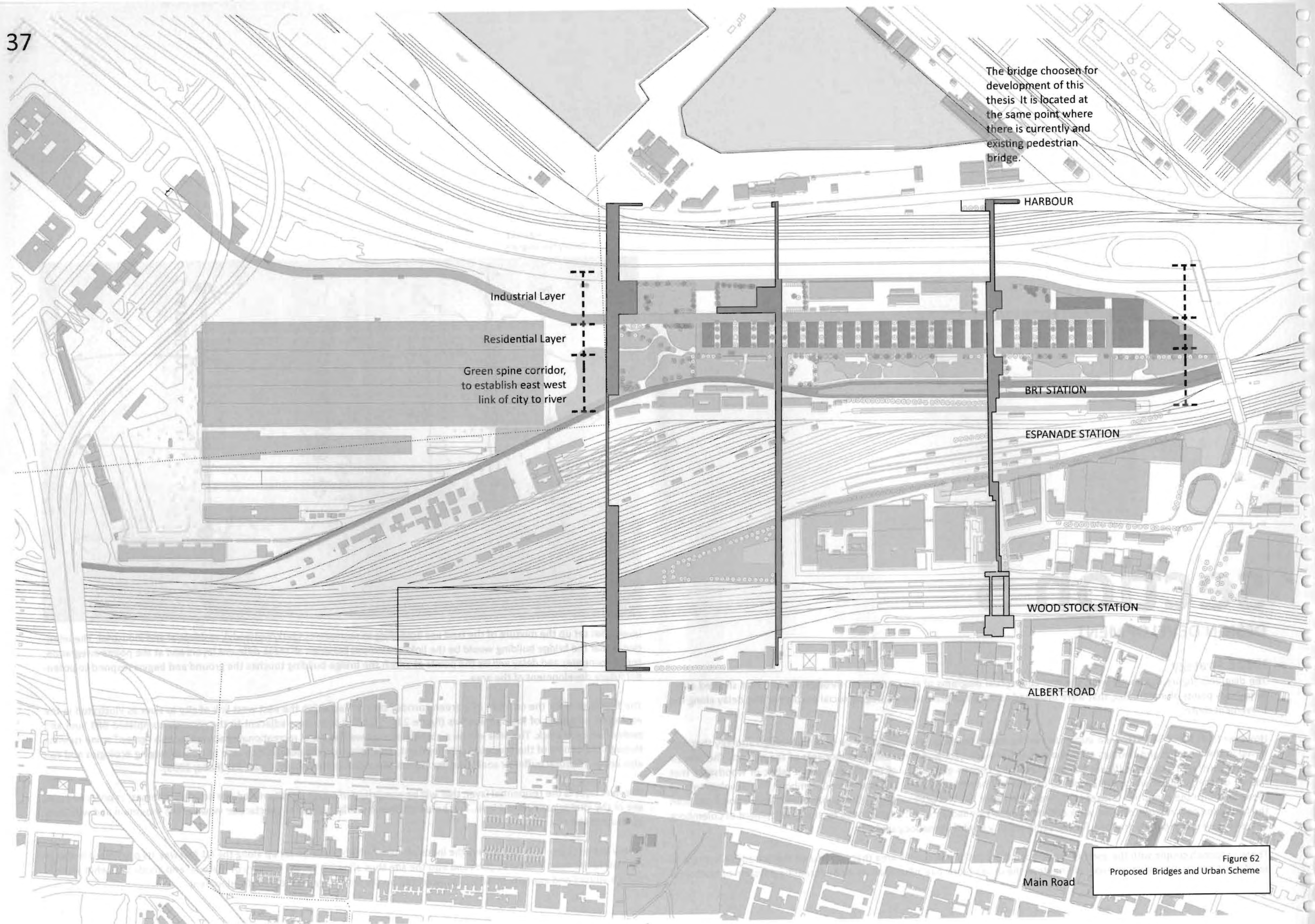
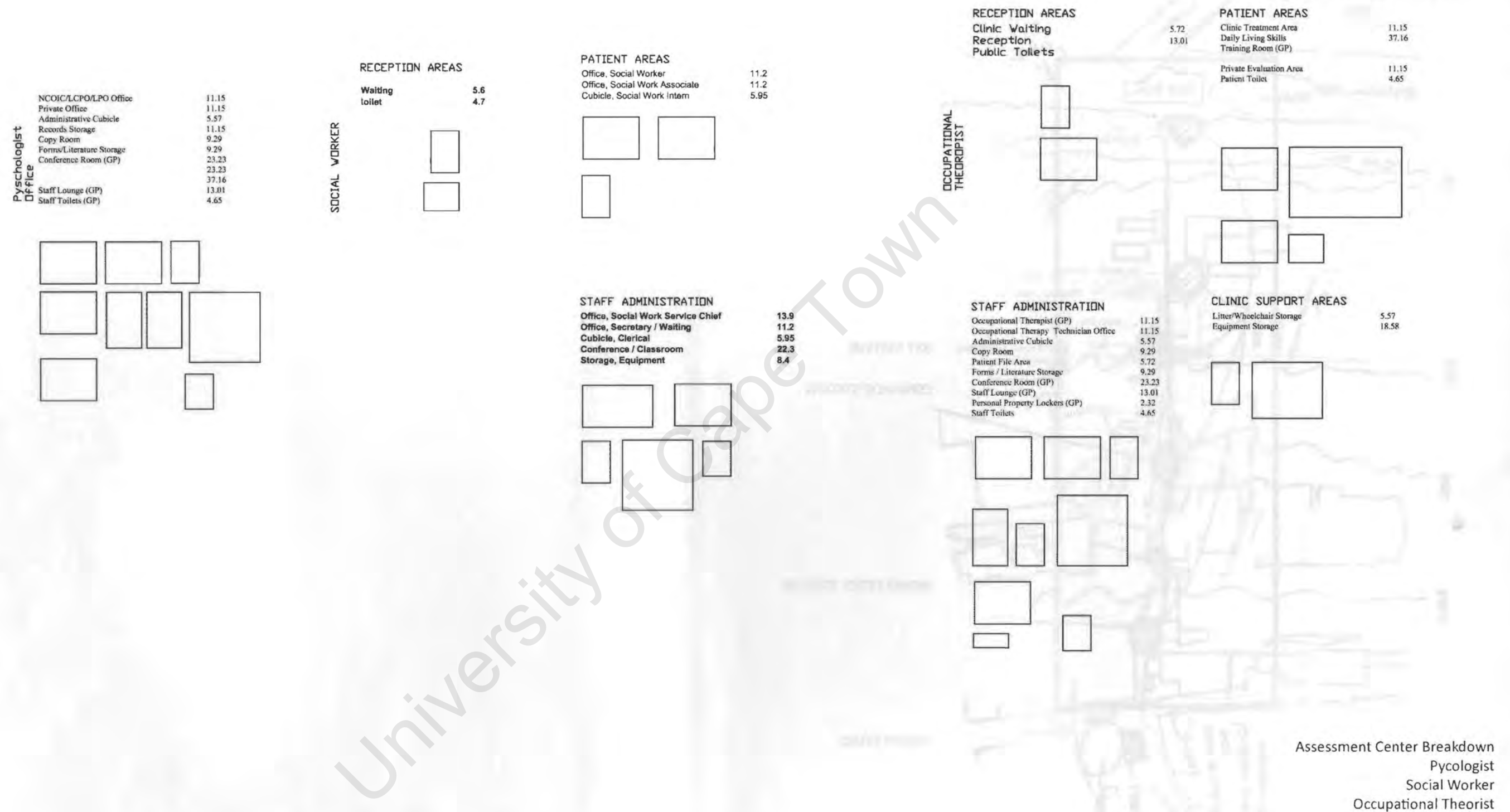


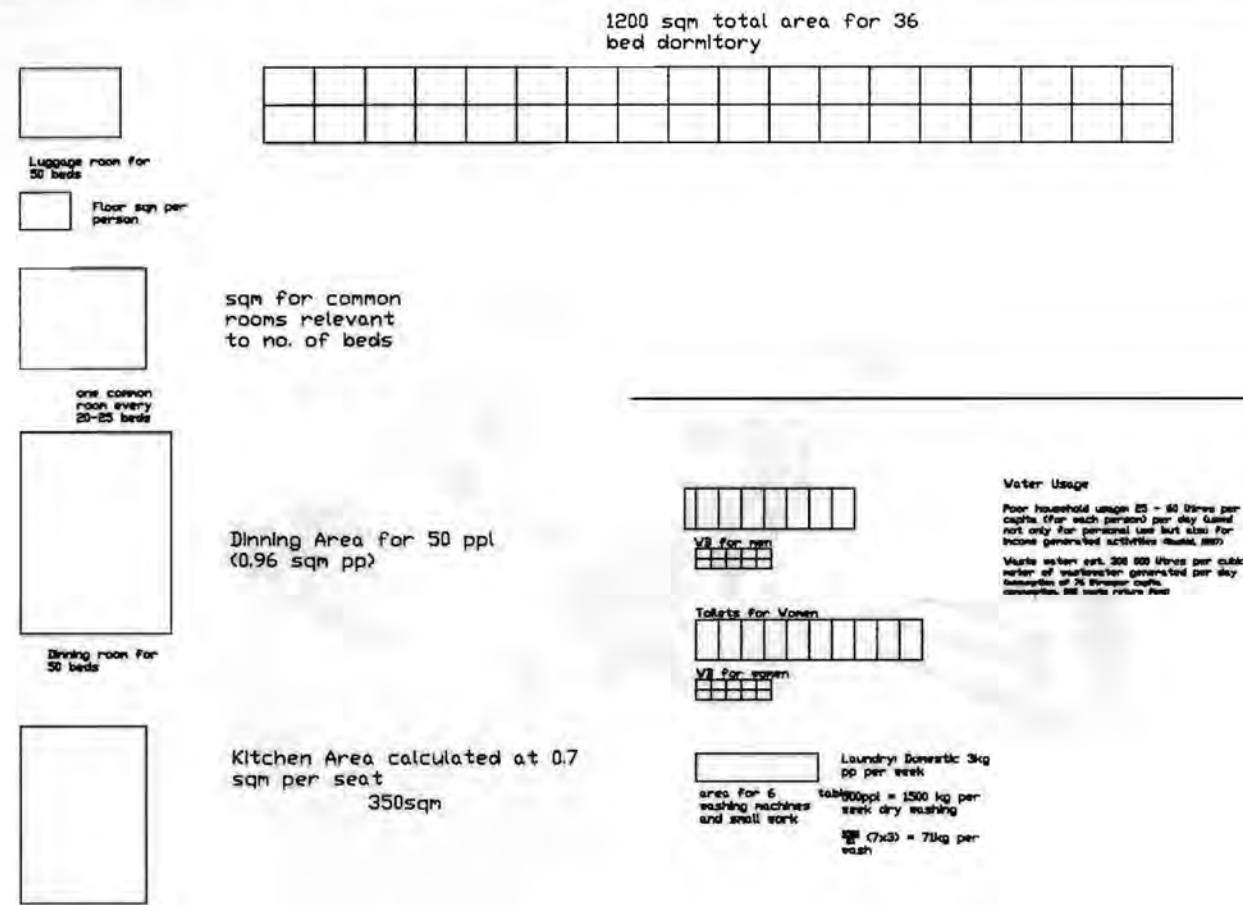
Figure 62  
Proposed Bridges and Urban Scheme



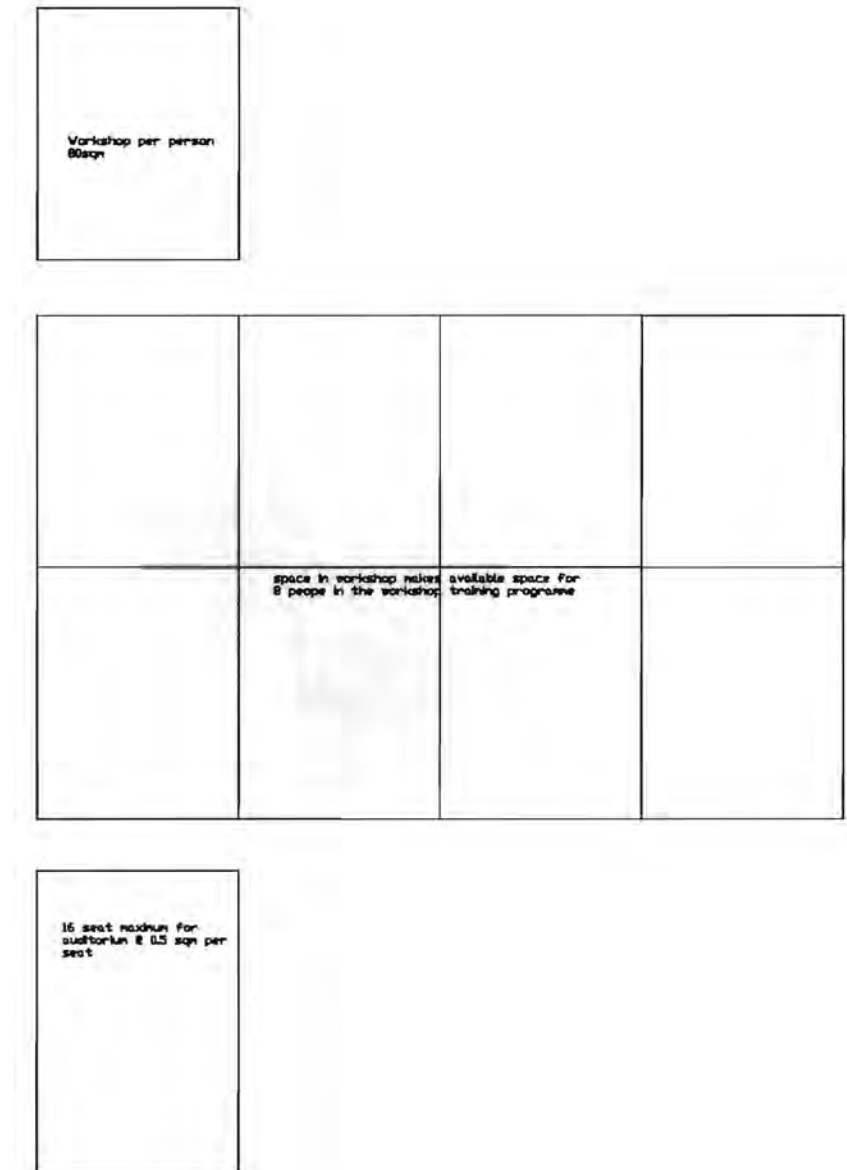




### Dormitory Accommodation, breakdown of spatial requirements from individuals to collective spaces



### Skills Development Center, Spatial requirements: Workshop and Business center programme requirements



### Programme

In response to the social conditions, and the need to support the growing harbour while providing the opportunity for skills development the project programme is made up of an assessment centre with 7 day dormitory accommodation and a skills training facility while also functioning as a bridge that links Woodstock to the harbour.

The Assessment Centre will include the offices for an occupational therapist, social workers, psychologist and a small clinic that will perform very basic medical assessment. Part of this programme will also include the offices for field and case workers. The assessment centre is equipped with multipurpose hall that can be utilized by people in the programme or from within the surrounding area. The intention is that this hall may also become increasingly utilized with future development of the Culemborg site.

As mentioned above the existing pedestrian bridge is subject to large groups of people, mostly from previously disadvantage backgrounds entering the city, some of which have skills but are incapable of finding work or having the initiative or knowledge to orientate themselves in the city appropriately. Others are without skill and are simply coming in everyday through desperation to find work. The idea is that the facility will cater for these large groups of people by providing them with a service whereby they are thoroughly assessed and then appropriately orientated within the city whether by means of job placement or skill development.

The process is that the field worker will be the first contact with the potential patient/student, and will take responsibility for that person during their first day in the 7 day assessment period. The first day will be characterized by that person being given a place to sleep, to clean up and food to eat. During the next 7 days that person will be assigned to a social worker and will be assessed according to an occupational therapist, and psychologist. At the end of this period this person will be orientated more accurately into an appropriate job opportunity or directed to an alternate facility for assistance or they will be included in the skill development programme offered by this facility.

The skill development component of this project has been designed to support the growing harbour, in terms of the ship repair industry and the skilling of people in metal work. This facility also includes a small business education centre.

The dormitory accommodation is made up of 6 bed dormitories and includes rooms for both male and female occupants. The dormitory provides beds for up to 36 people at a time. There various programmatic spatial requirements are listed in the drawings above. In the next section of the design development the project seeks to find the appropriate spatial relationships for these programmes that they may begin to create spaces that encourage places of integration, social encounter and delay in the journey from woodstock to the harbour.

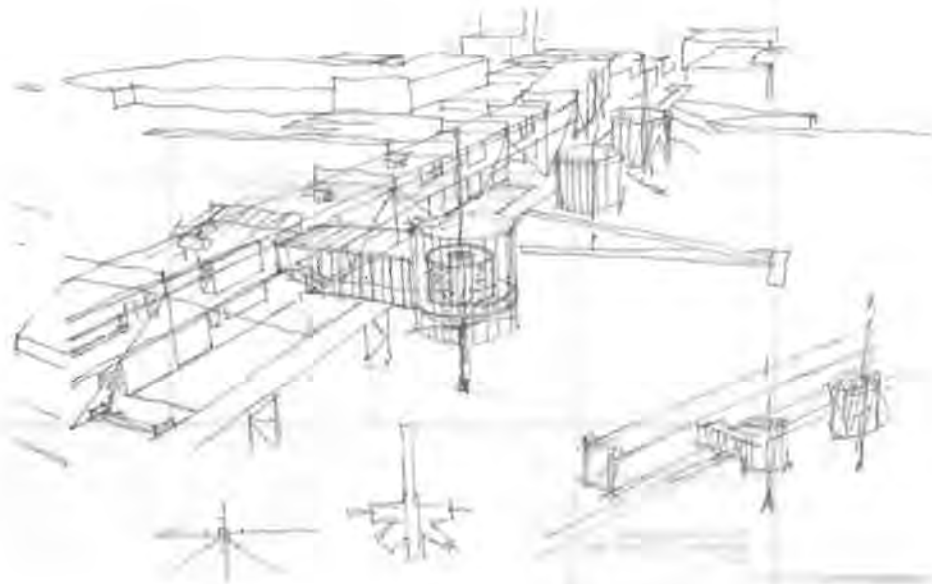


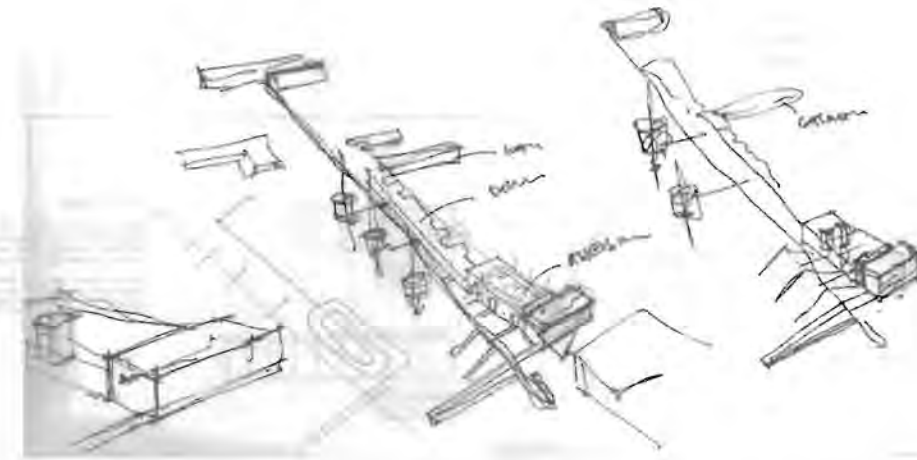
Figure 64: initial 3d sketches for the potential realisation of bridge building

### Spatial Relationships

In the same way that the greater design intention has been to find strategic points at which a series of bridges begin to integrate with the Culemborg barrier, the points of entry and the circulation within the bridge corridor become the important integrating factors for the programmatic functions for the bridge building. The early diagrams (figure 61) as mentioned illustrates the design intention of finding the points that intersect the bridge along its journey. This diagram was then tested and represented in the figure 63, indicating points along the movement route that hold the potential for places of integration social encounter and delay. These points would also need to encourage extended activity along the length of the bridge.

In reflection to these ideas the design decision was to create the entry points so that 'foyers or waiting areas are essentially part of the bridge, and that the programme from inside the building spills on to the bridge corridor almost as though it were a social street. Thus the bridge corridor becomes the place for social encounter and provides the opportunity for the people to exchange information, knowledge and skill amongst each other.

Once the entry points had been decided upon it was a question of how to use the programme of the building to encourage the greatest opportunities for interaction between the people from all the aspects of the bridge buildings programme (i.e. 7 day assessment program, the skills development programme and the harbour workers). Therefore the design decision was to use the dormitories as the bridging element that links the skills development and assessment centre (Figure 68: Ground Floor Plan). This gives the people within the 7 day assessment accommodation an opportunity to enter the dormitories from two ends encouraging movement throughout the building and eliminating dead ends that could potentially become security risks. Furthermore the placement of the assessment centre and the skills development at alternate ends helps to distribute the activity along the length of the bridge while also functioning as surveillance points. Figures 68-70 present the overall spatial layout in correspondence with the diagrammatic analysis according to movement systems and service cores.

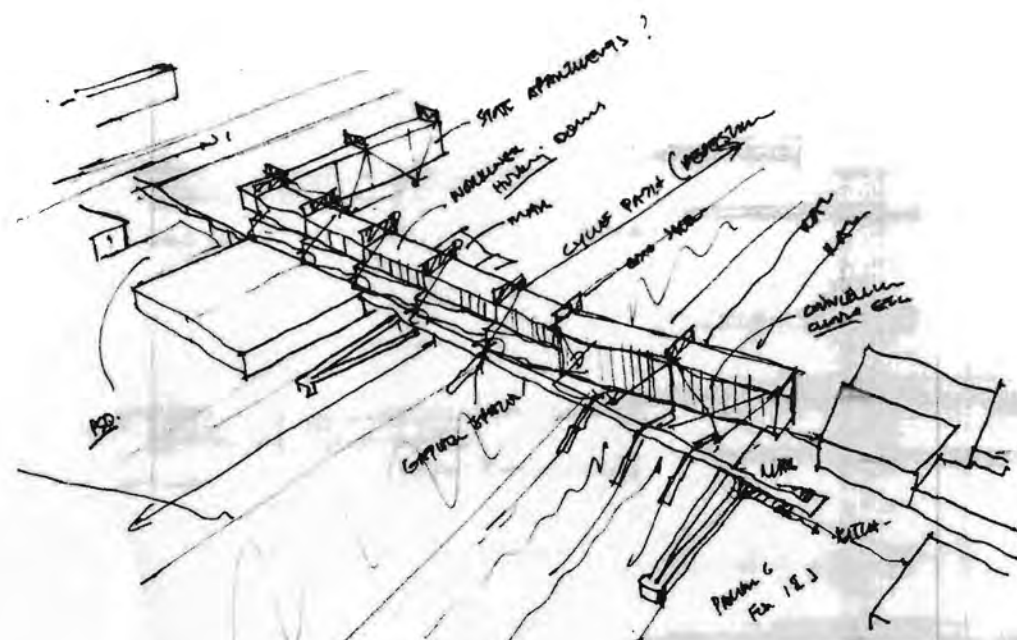


In the first floor plan (figure 69) the security and permit offices of the harbour have also been brought forward to the Culemborg side of the N1 and now relate more closely with the entrances of the dormitory accommodation and the skills development facility thereby creating opportunity for social encounter between all these different people at different stages of their integration into the city.

The diagrammatic sections in figures 66 and 67 illustrate the sectional development along the journey of the bridge corridor, representing the basic ideas of how the bridge grows into its various programmatic requirements. Figure 67 illustrates the design ambitions of creating an integration of spaces between the public corridor and the internal functions of the project, by means of split levels and movement systems.

The current realization of some of these ideas can be seen in the 6 sections taken along the journey from woodstock station to the harbour (figures 71-76). In the sectional development the assessment center is at a split level to the bridge corridor, thereby giving a sense of separation from the publicness of the bridge, to the more private requirements of the counselling and assessment offices. This relationship is also added to by means of perforated metal screens that allow for a diffused visual connection between the spaces. The movement from the bridge level and the level of the waiting area and assessment offices is delayed by means of a ramp, which also provides access for elderly or disabled people. This ramp continues to the level of the dormitories which has been placed above the public corridor of the bridge. The entry point at this level is into a common area which related to the staff lounge and supervisors office. The ramp continues further to the next half level which enters into the main group theory room for the facility. This room has spectacular views of Table Mountain and the city. It is also a much more private area separated from the activity of the bridge corridor.





The placement of the Assessment centre, dormitories and the skills development also related to the urban design scheme, whereby the Assessment centre, under the idea of treatment and counselling, has been placed in relation to green east west corridor, the dormitories in relation to the residential layer and the skills development in relation to the industry layer of the urban design scheme (see figure 68).

Furthermore from the site investigations it was documented that the informal trade tended to congregate at the entry points of the Woodstock station but also at the start of the pedestrian bridge and on the bridge itself, particularly at the points where the stairs lead down to the railway platforms (see long section of existing bridge, figure 36). This has led to a potential scenario that the entry points into the various programmes of the bridge building will also be accompanied by an element of informal trade.

Therefore by means of the strategies mentioned above the intent is for the activity of the entrances and the manipulation of the space at these points to create places along the journey that give orientation and a variety of spatial experiences. These conditions are expressed through the series of sections illustrated in figures 71 -76.



Figure 66 Sequence of sectional development diagrams

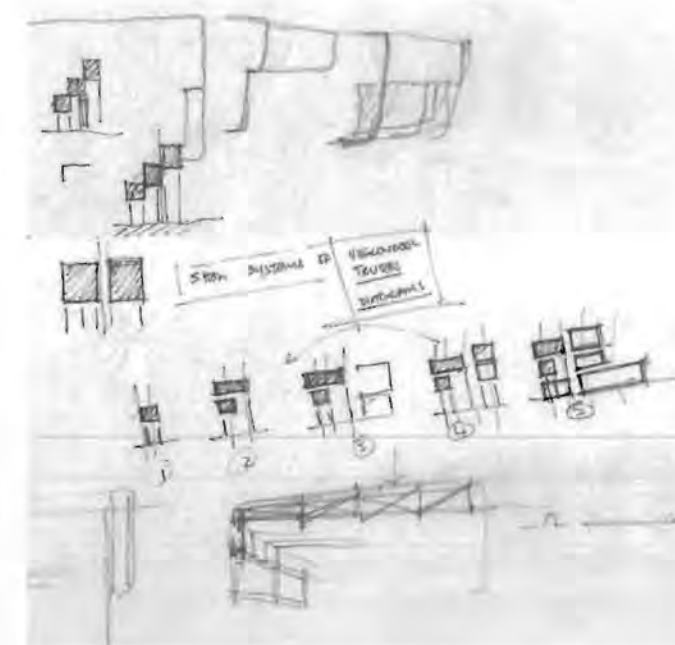


Figure 67 Integration of spaces, through split levels and movement systems

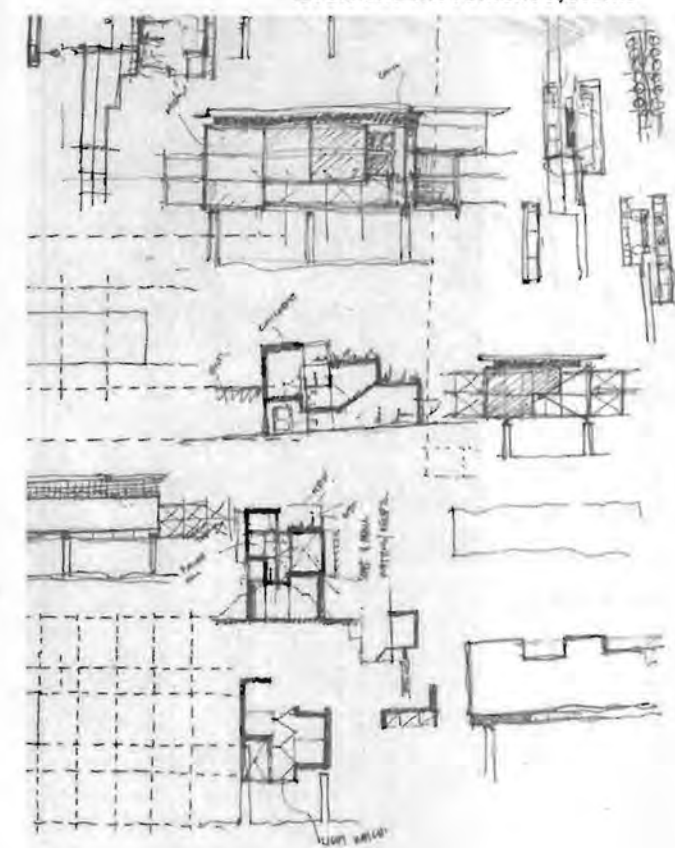
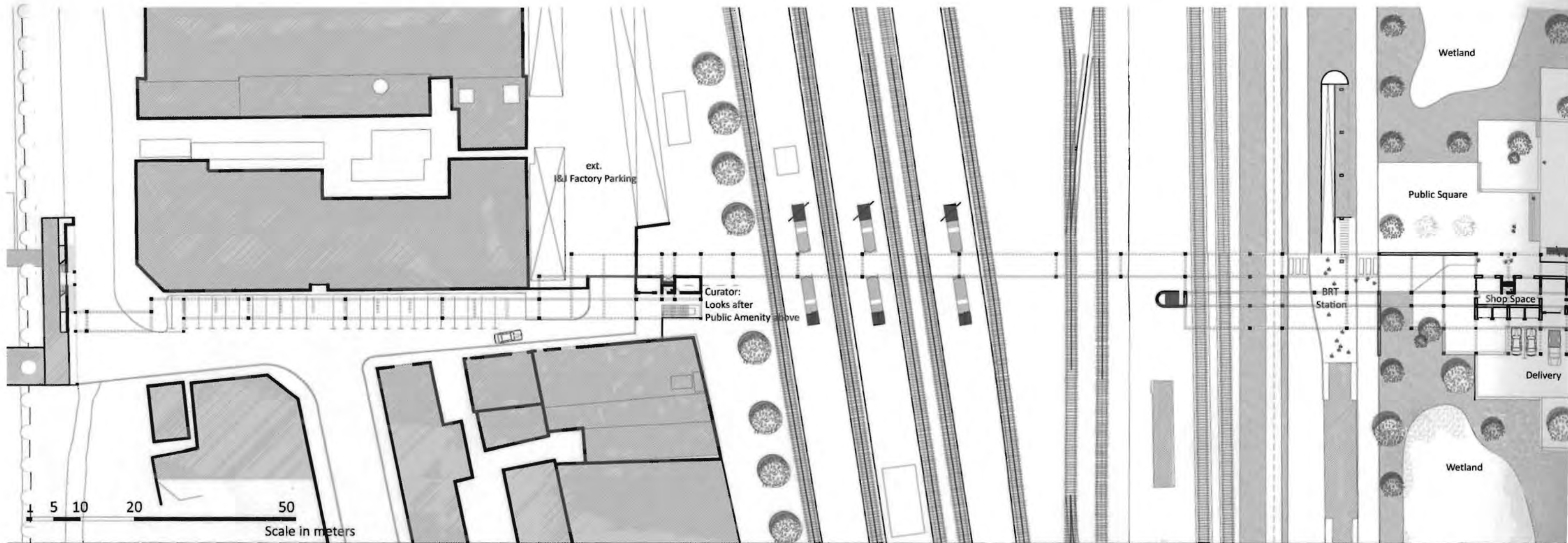


Figure 65: Physical and Digital model explorations of initial design ideas.



Figure 68: Ground Floor Plan, with diagram of spatial layout



Woodstock Station

Espanade Station

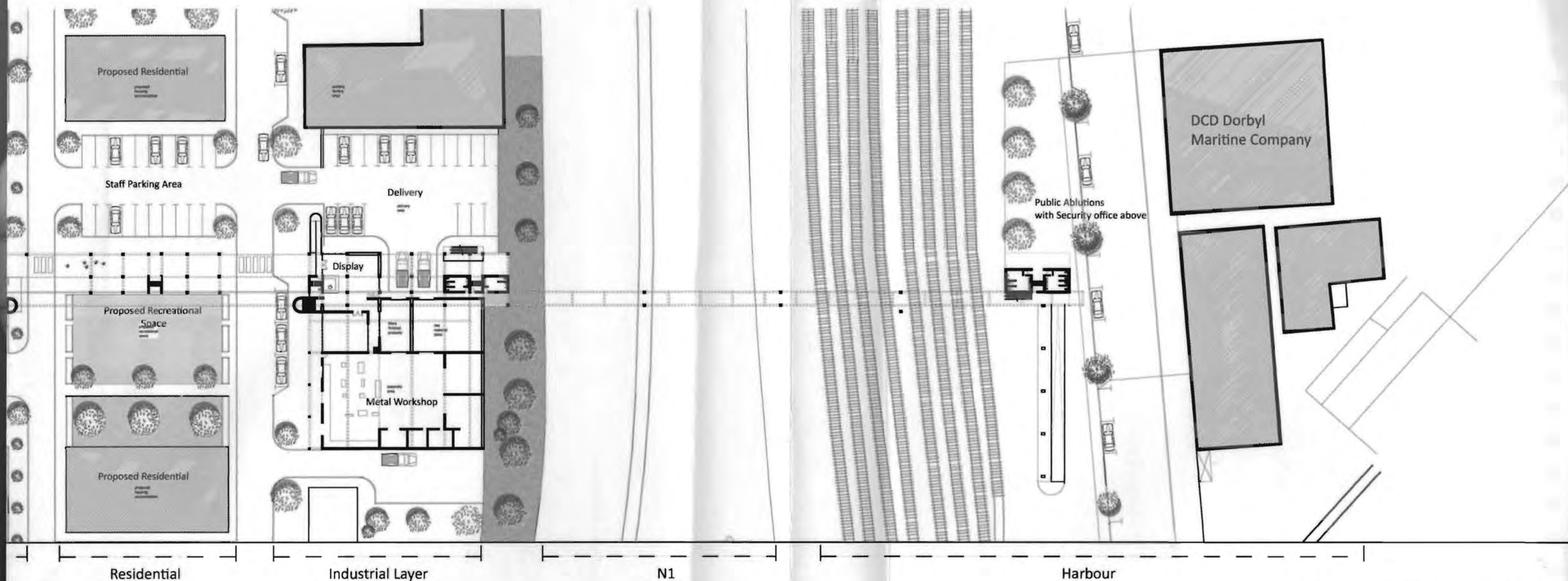
Green Spine/Recreational

Summary of b

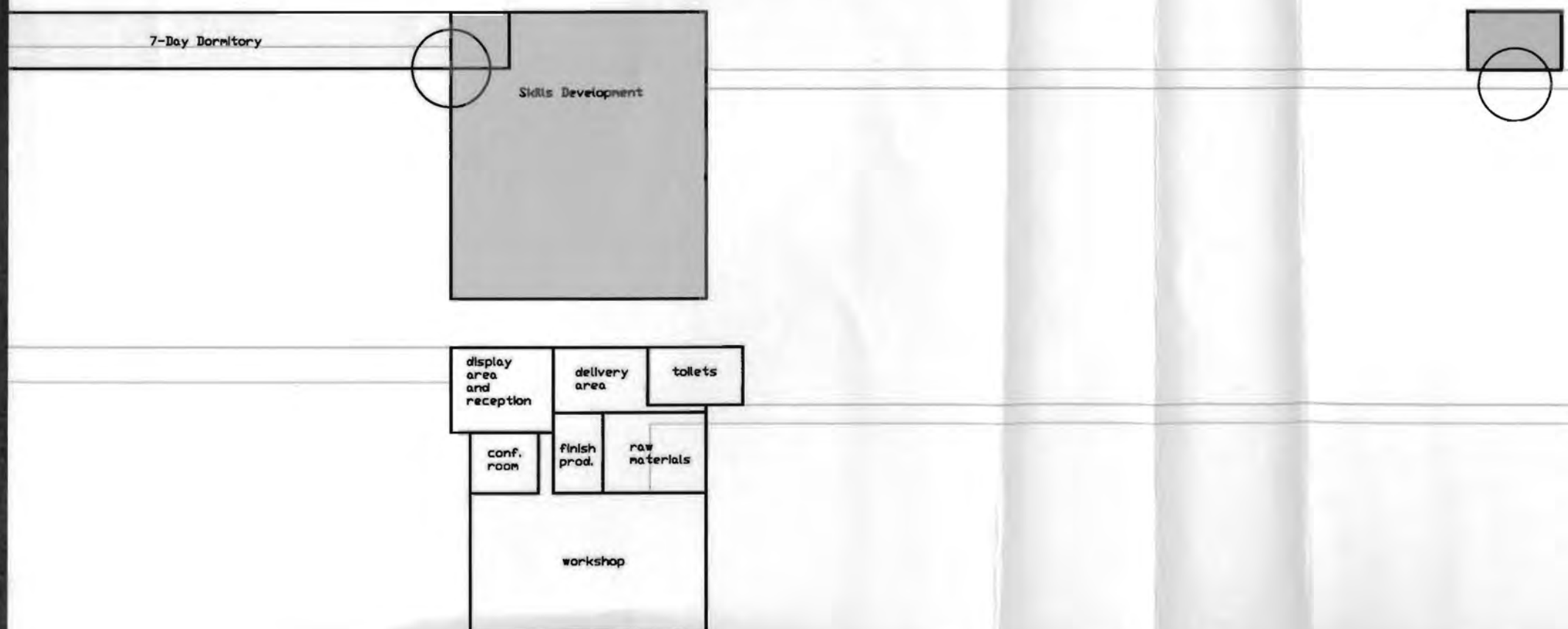


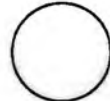





rentable  
shop  
space  
storage





Ground Floor Plan



-  Main entry points of the building
-  Assessment
-  Dormitory
-  Skills development
-  Bridge
-  Public Ablutions combined with appropriate programme at alternate ends

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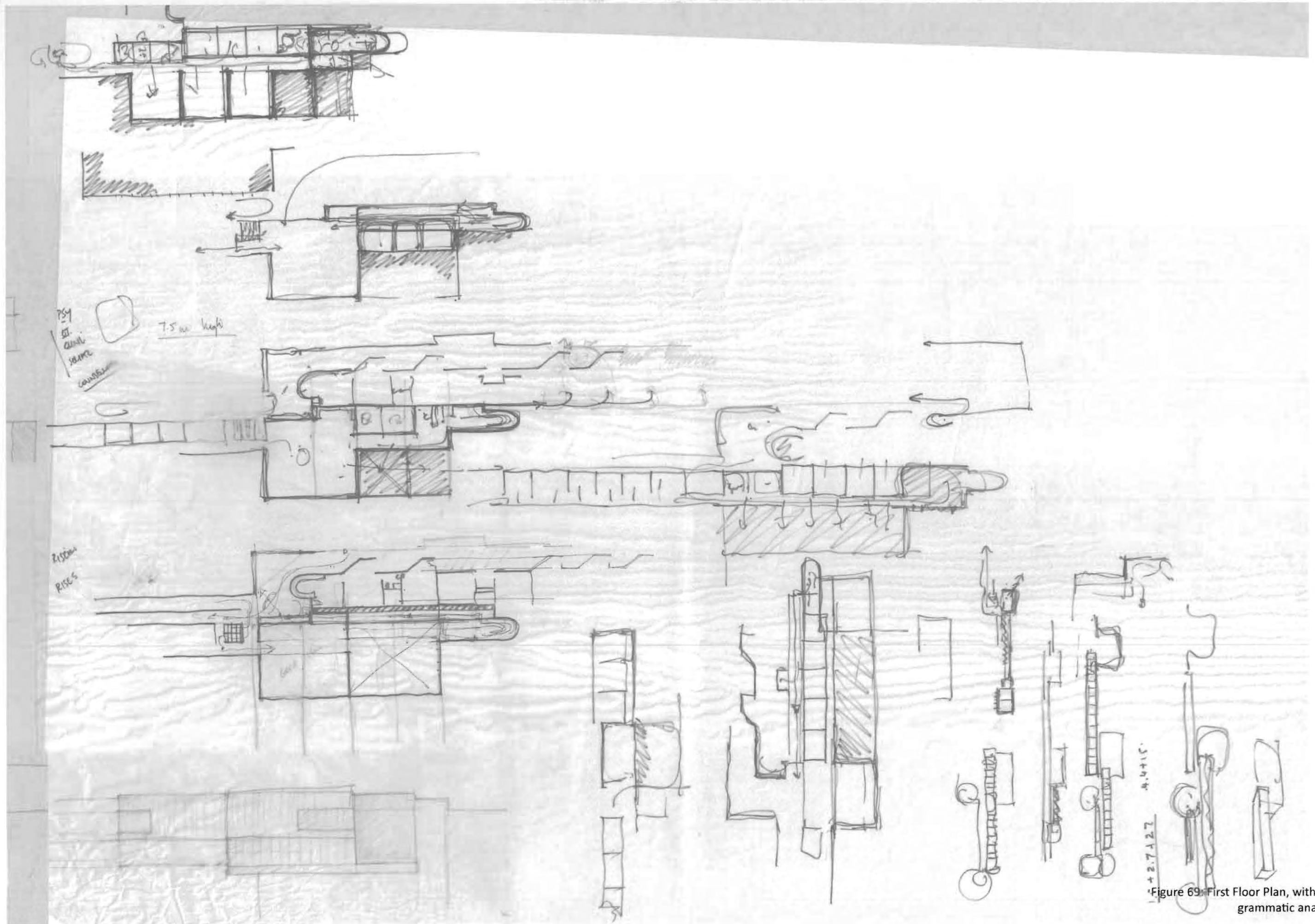
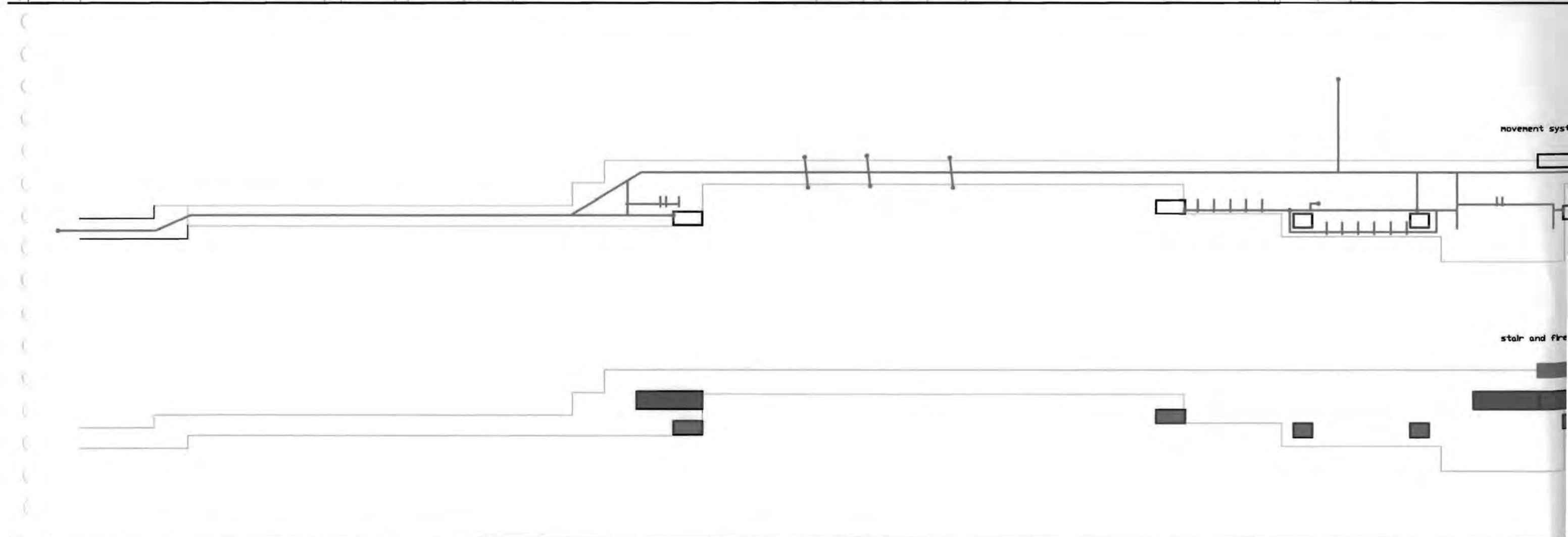
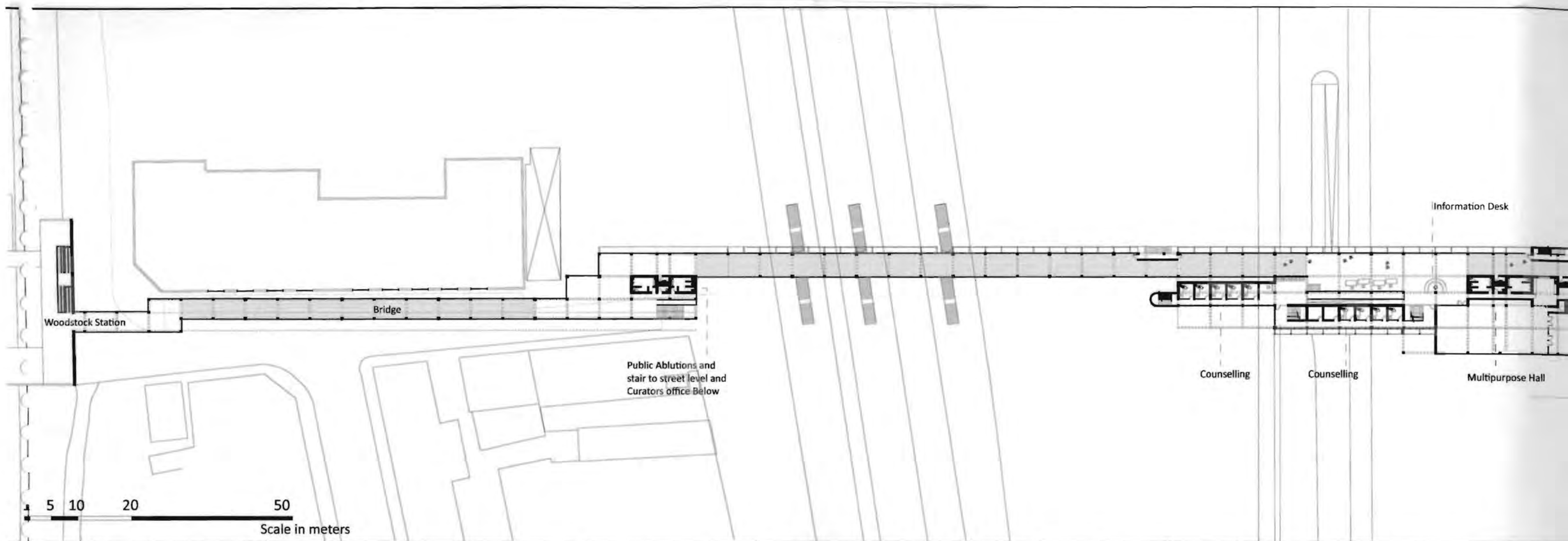
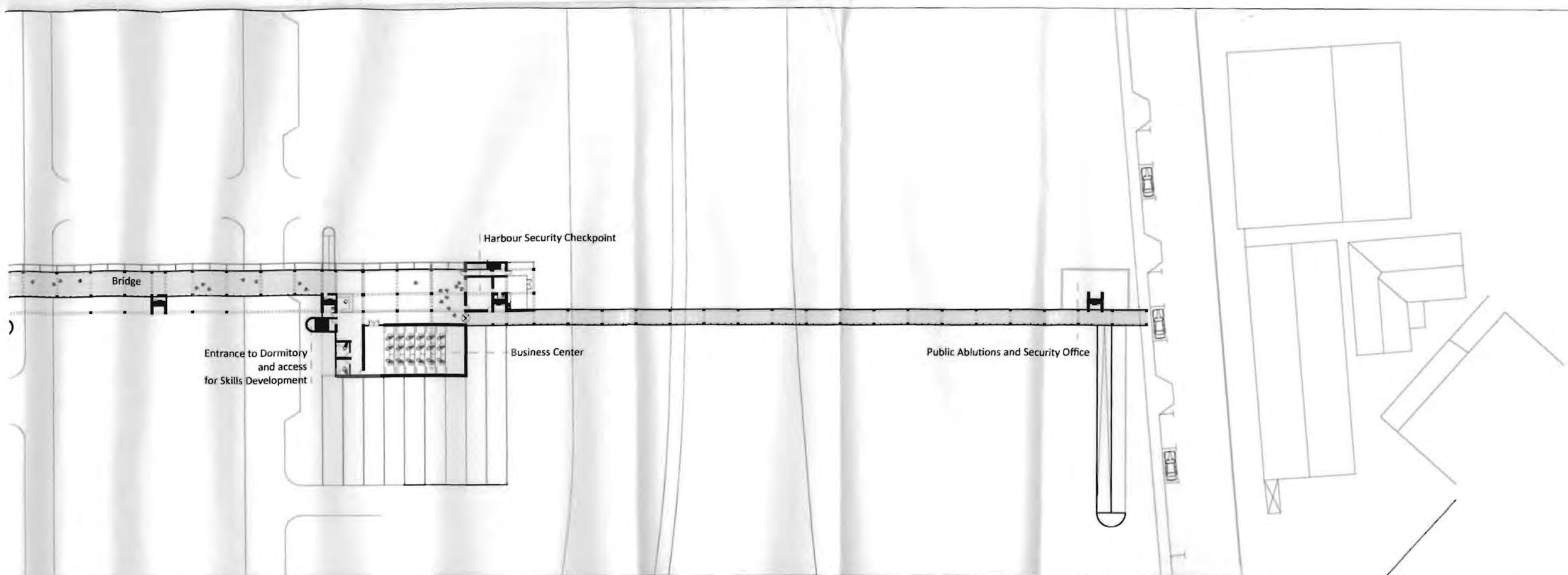


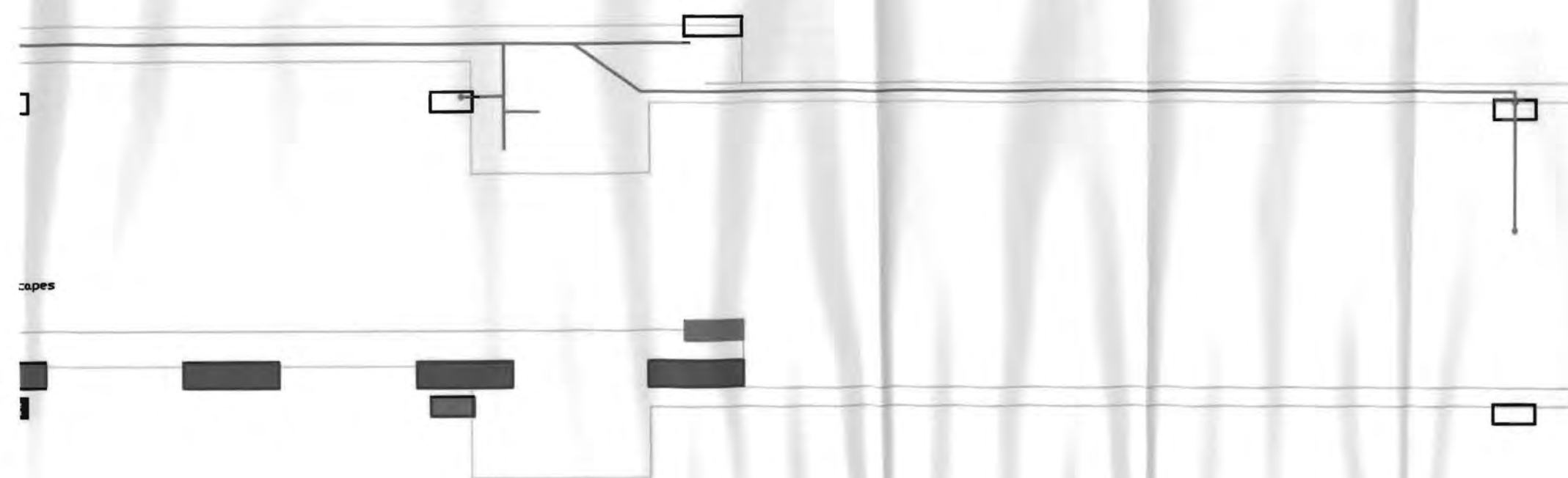
Figure 69: First Floor Plan, with diagrammatic analysis



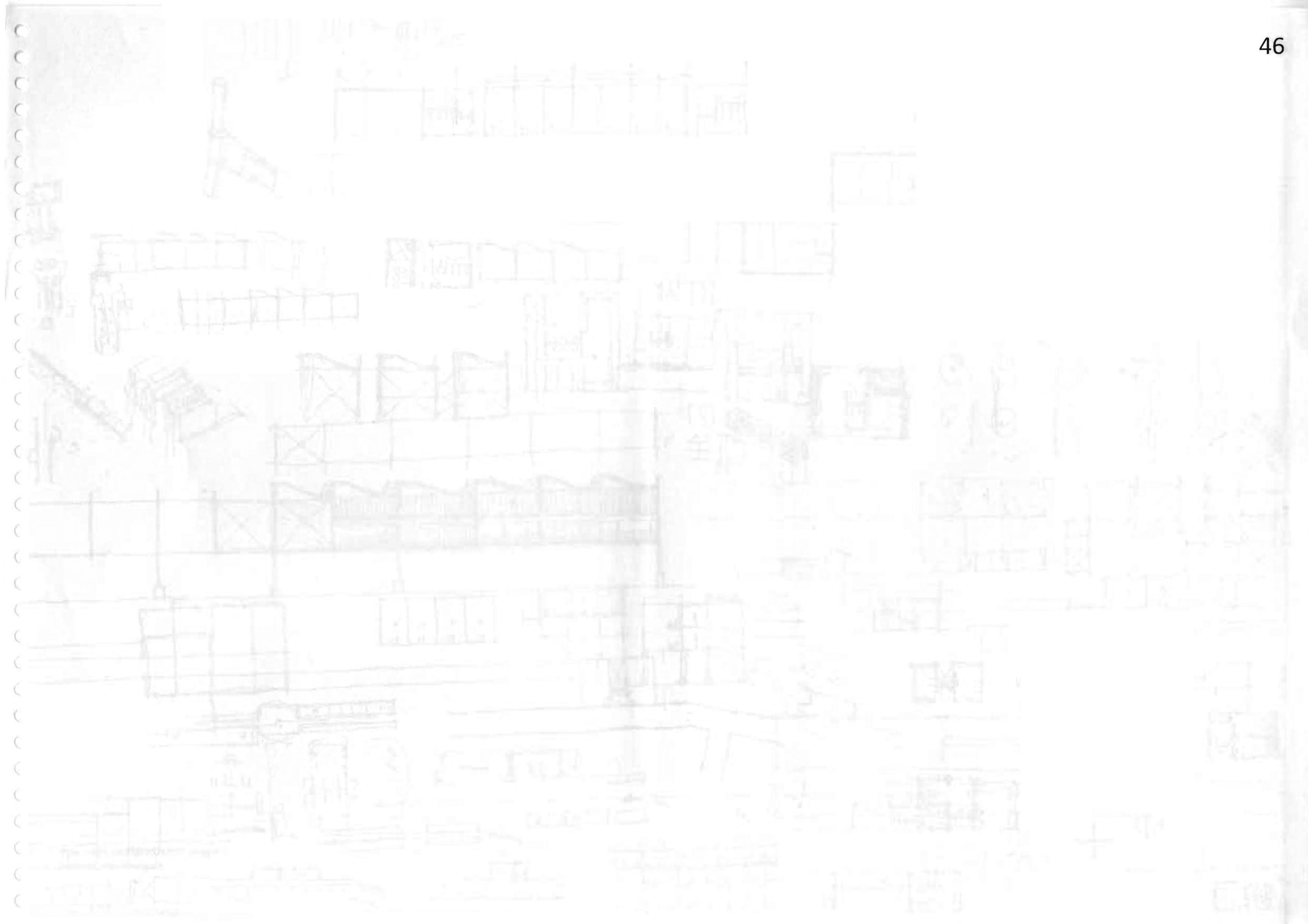




First Floor



- movement systems
- fire escapes
- service cores
- access stairs





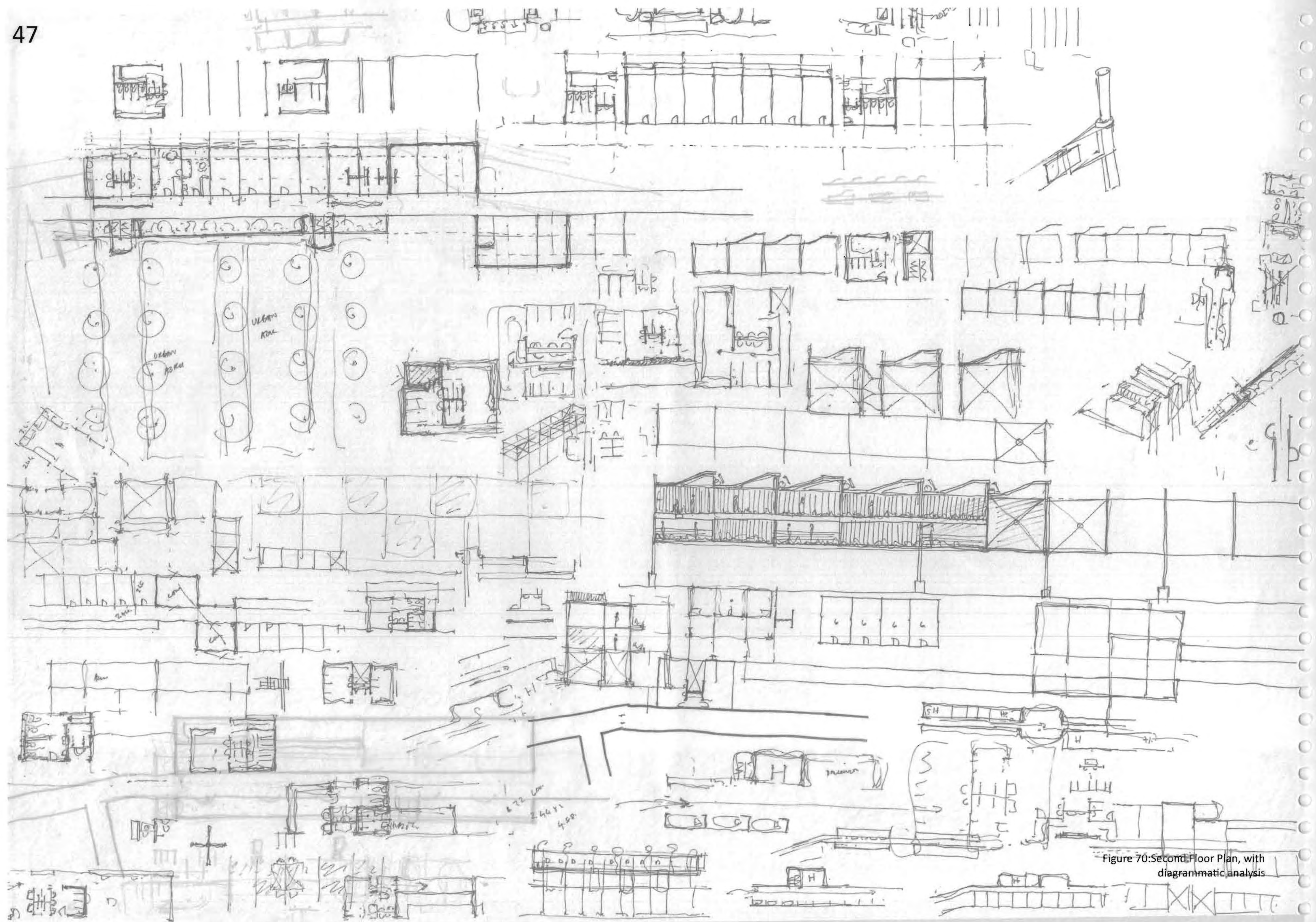
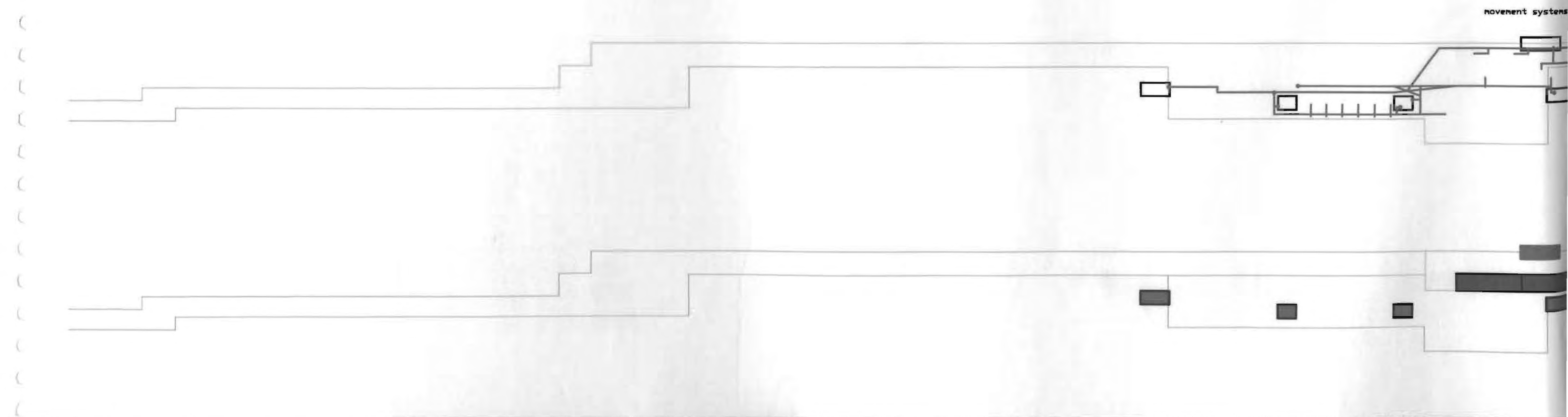
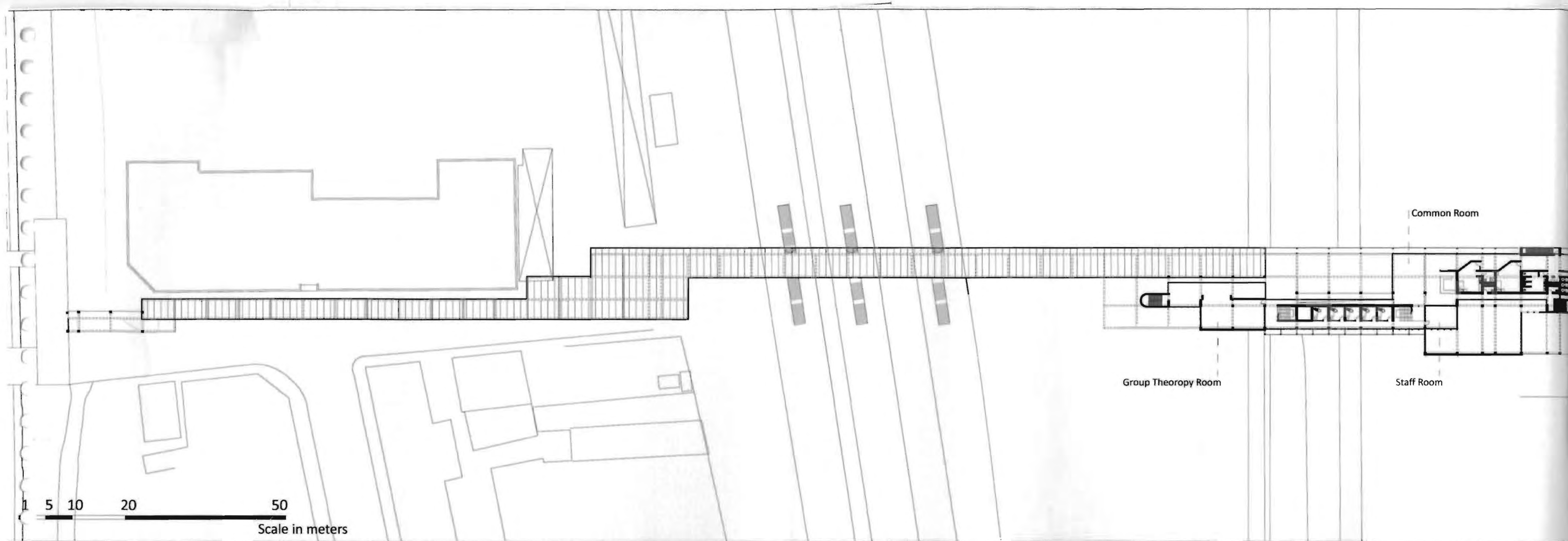
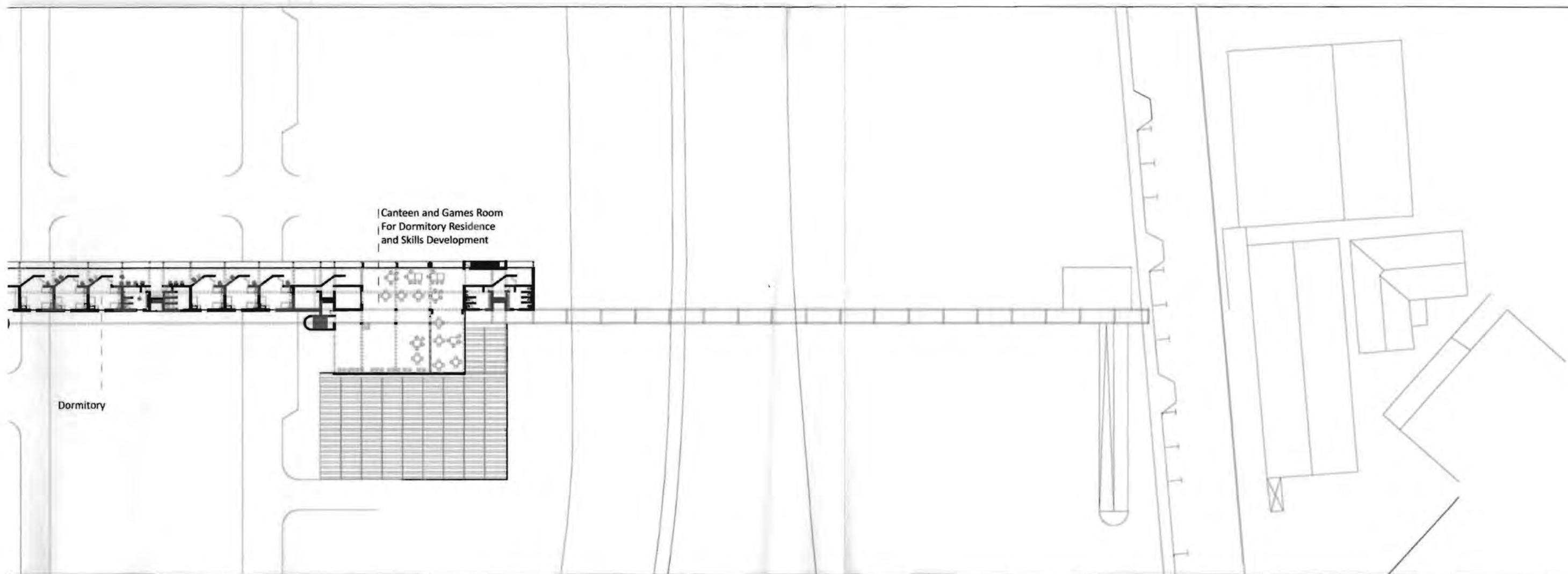
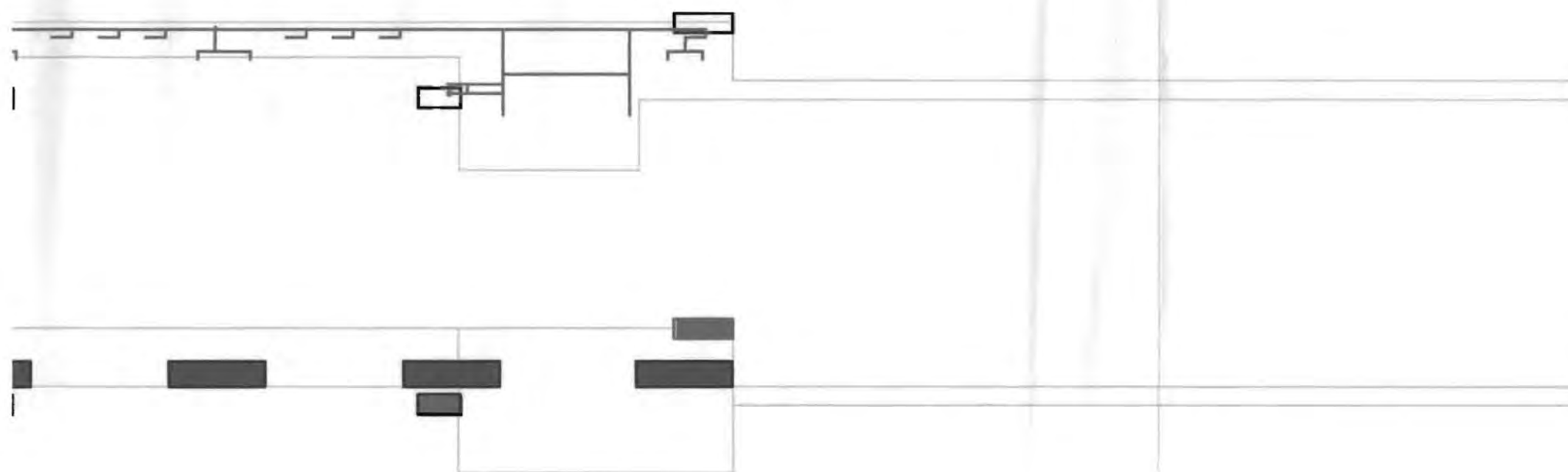


Figure 70: Second Floor Plan, with diagrammatic analysis





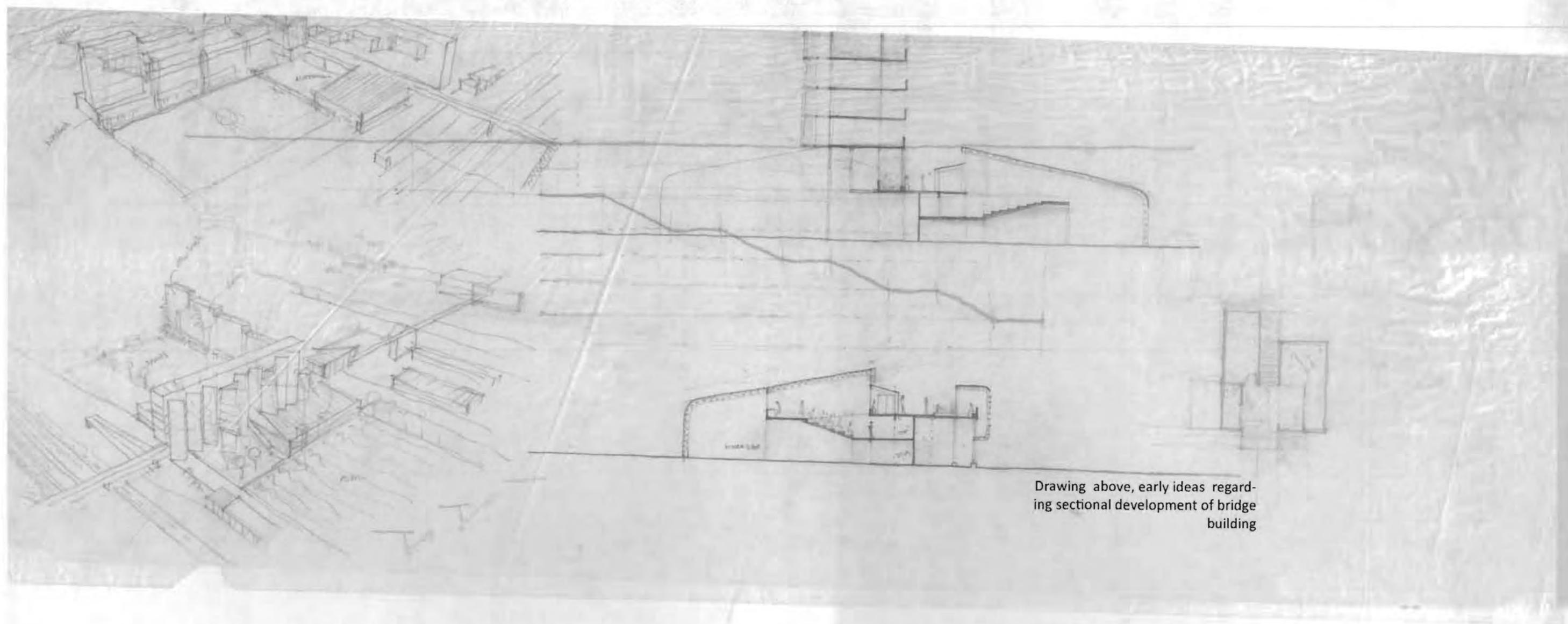
Second Floor



- movement systems
- fire escapes
- service cores
- access stairs

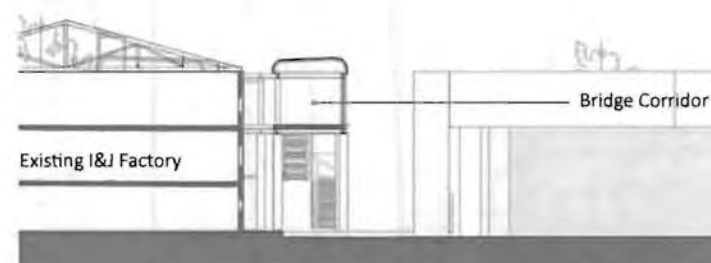






Drawing above, early ideas regarding sectional development of bridge building

Figure 71



## Section One

Building as bridge linking to Woodstock station.

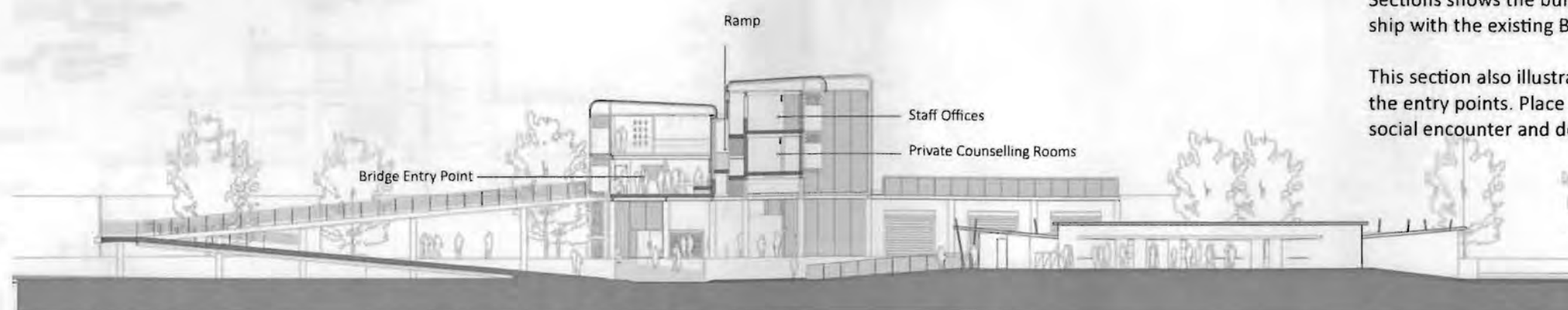
Figure 72



## Section Two

Bridge Grows with its first programmatic functions: assessment center counselling offices. First stage assessment offices at half level to public bridge corridor

Figure 73



## Section Three

Sections shows the buildings relationship with the existing BRT station.

This section also illustrates the first of the entry points. Place of integration, social encounter and delay

Existing BRT Station



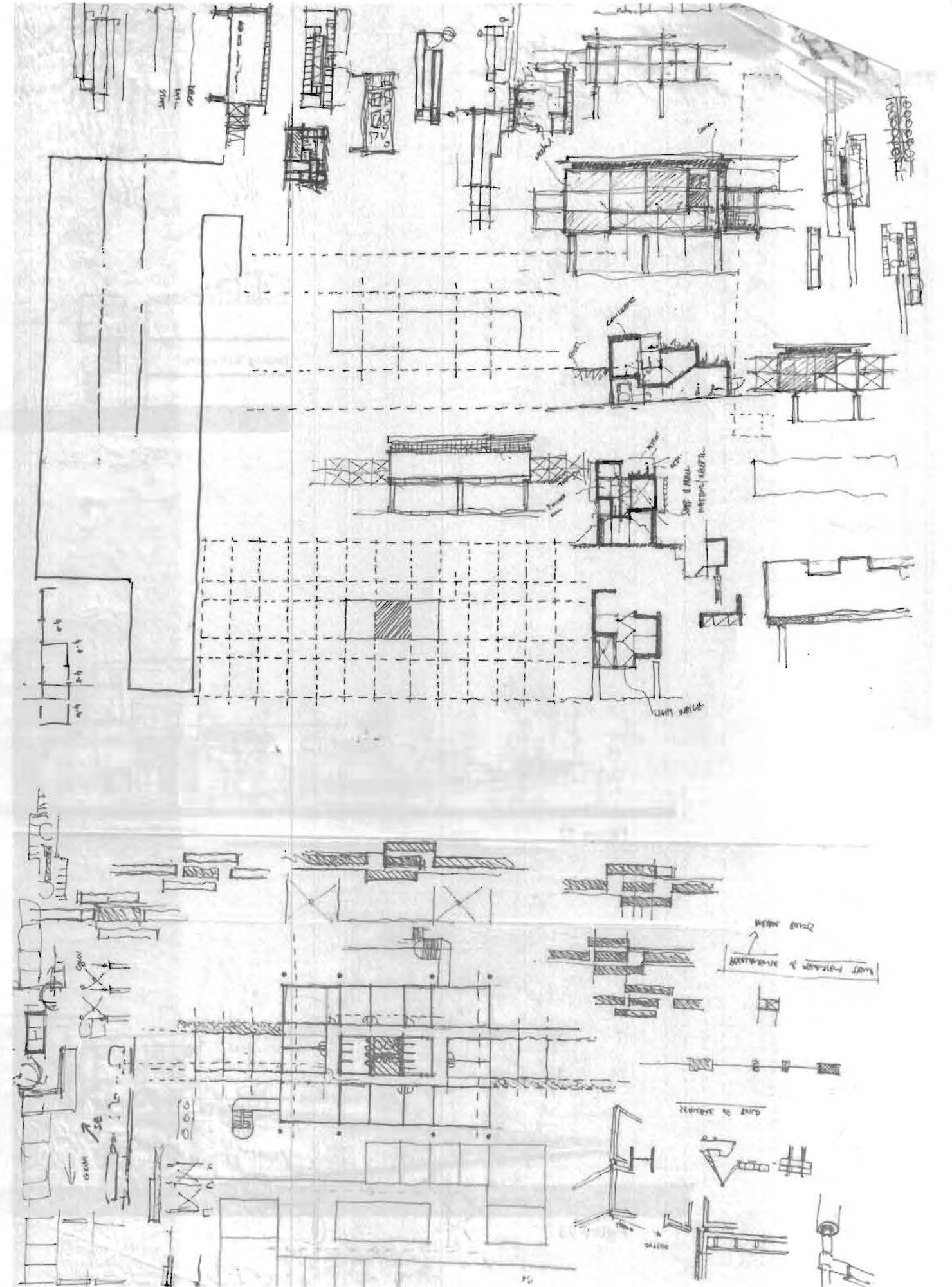
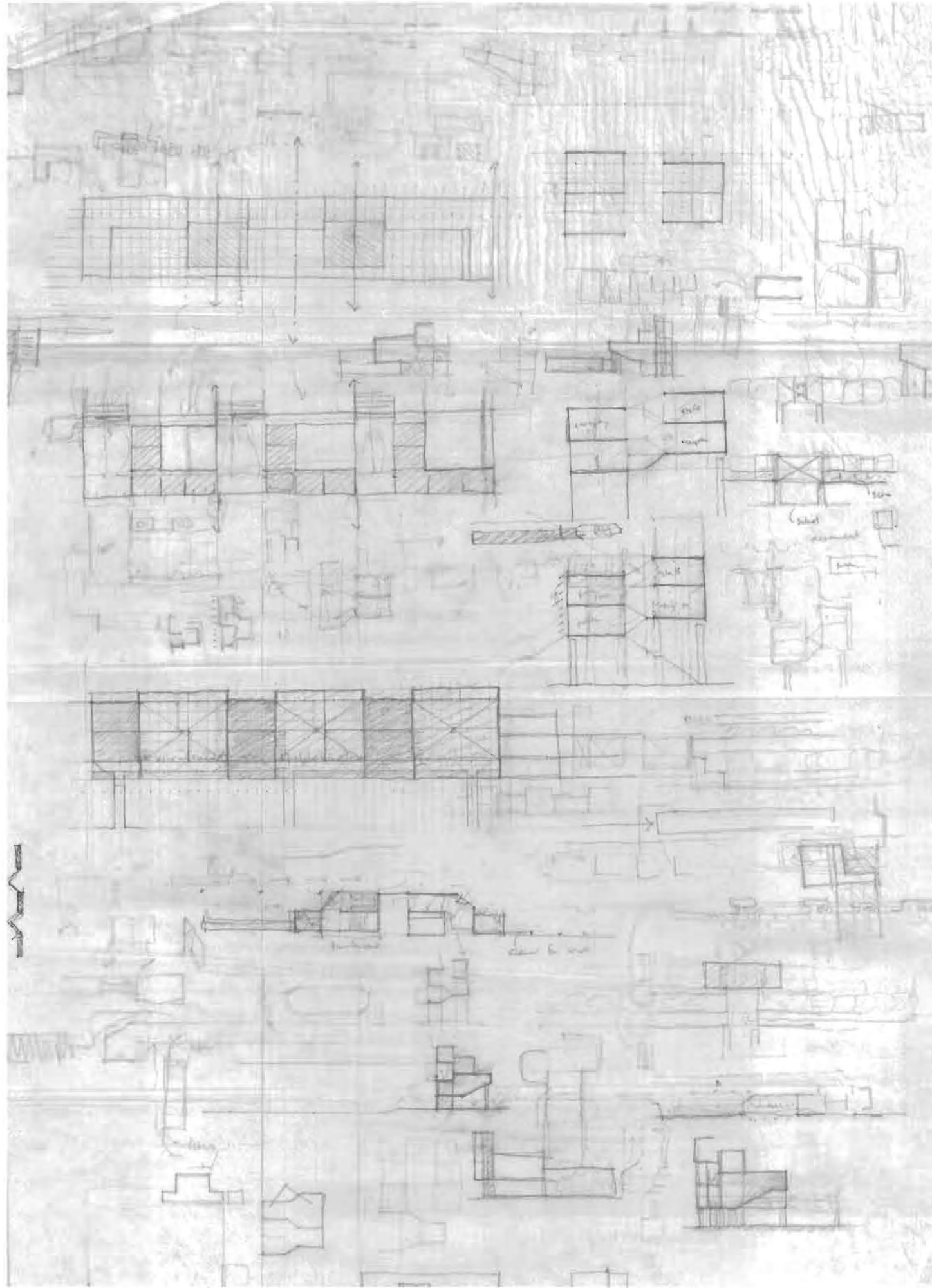
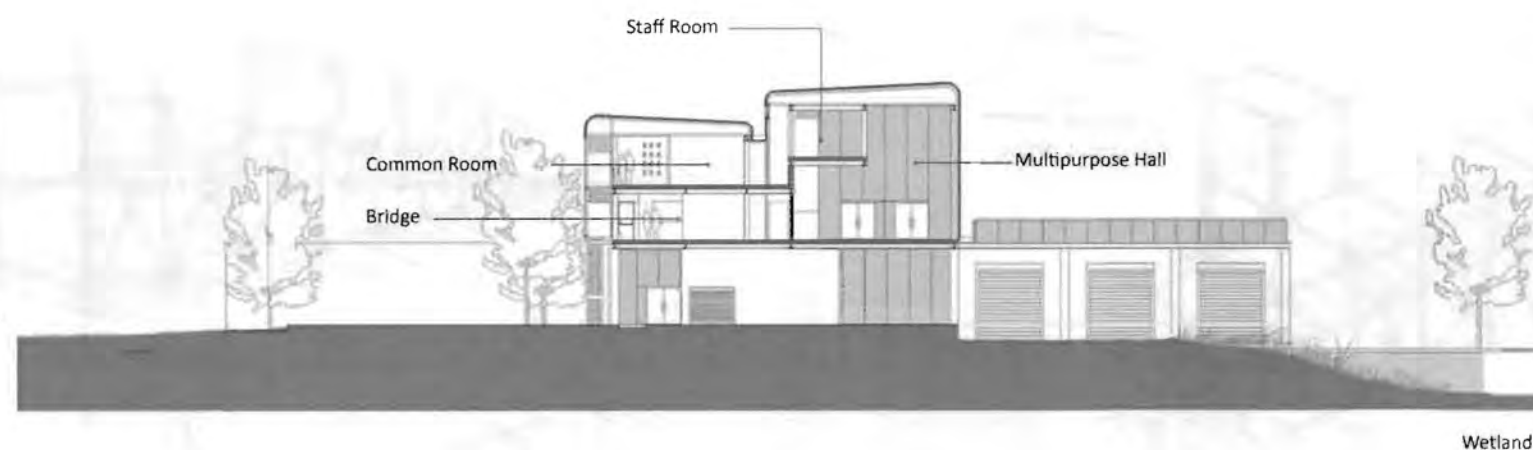


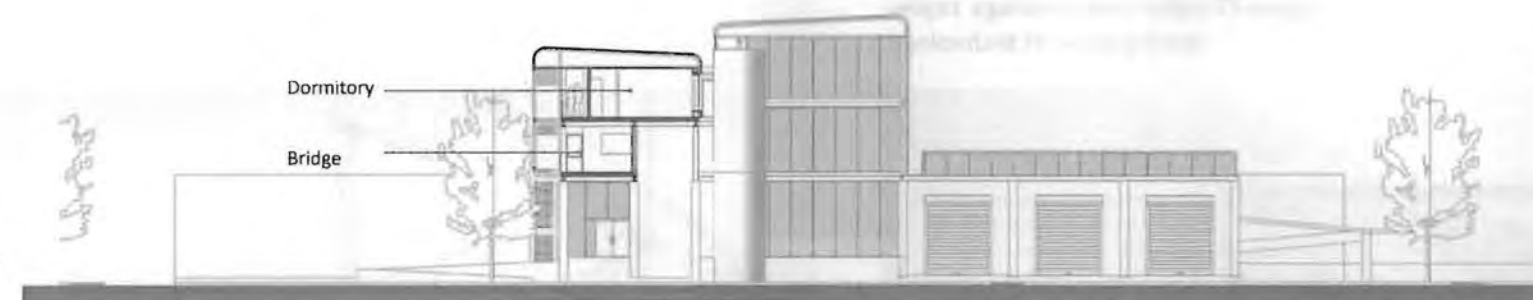
Figure 74



## Section Four

Section through multipurpose hall,  
Common room and staff room.

Figure 75



## Section Five

Section through the dormitory component of the bridge building. Dormitory accommodation is on second floor, leaving the level of the bridge for public movement and engagement

Figure 76



## Section Six

Section through Second entry point, namely the skills development component of the bridge building. This area has a number of entrances leading off it, including business center, dormitory accommodation, access to skills development and check point for harbour entry.



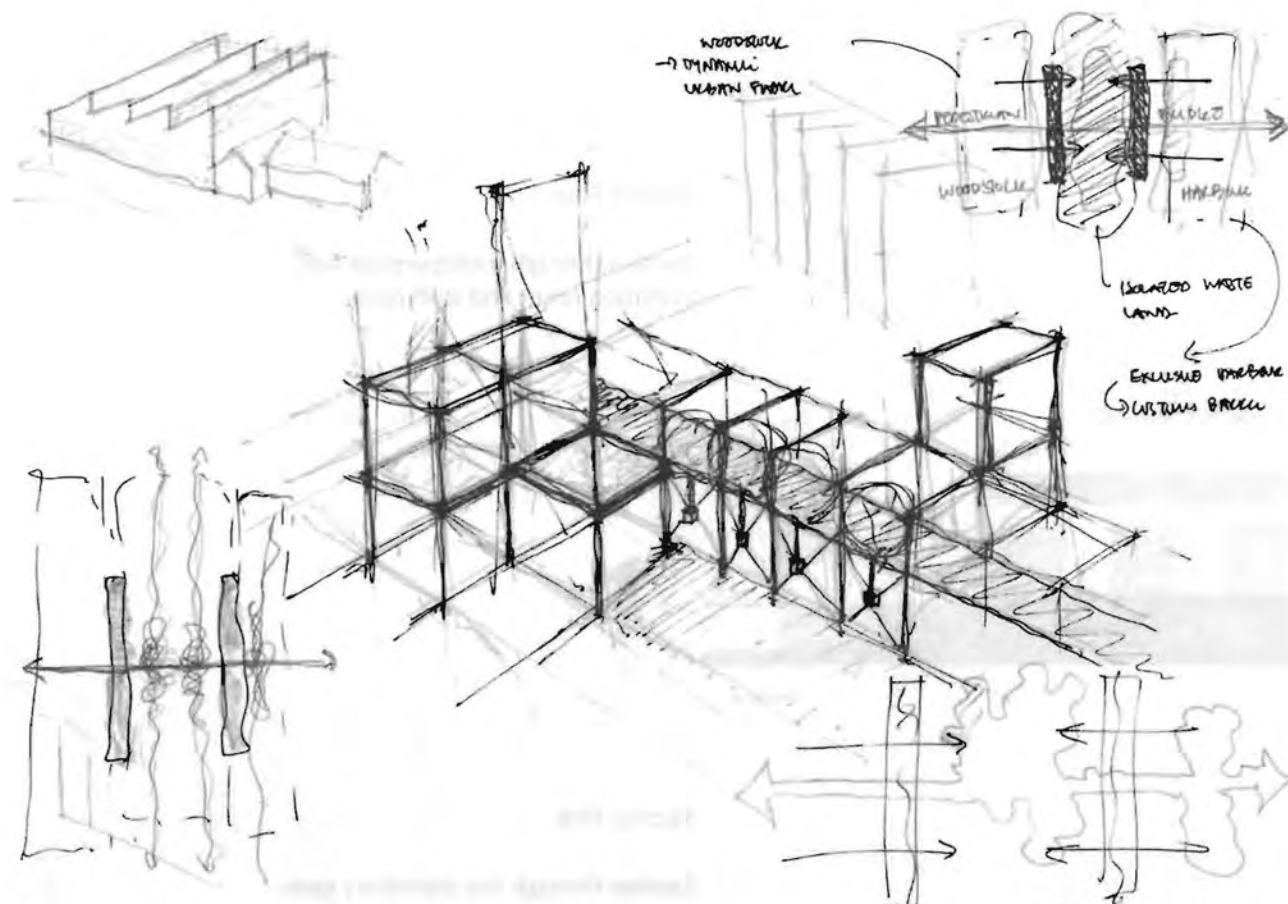


Figure 77 initial site drawings representing ideas of technology

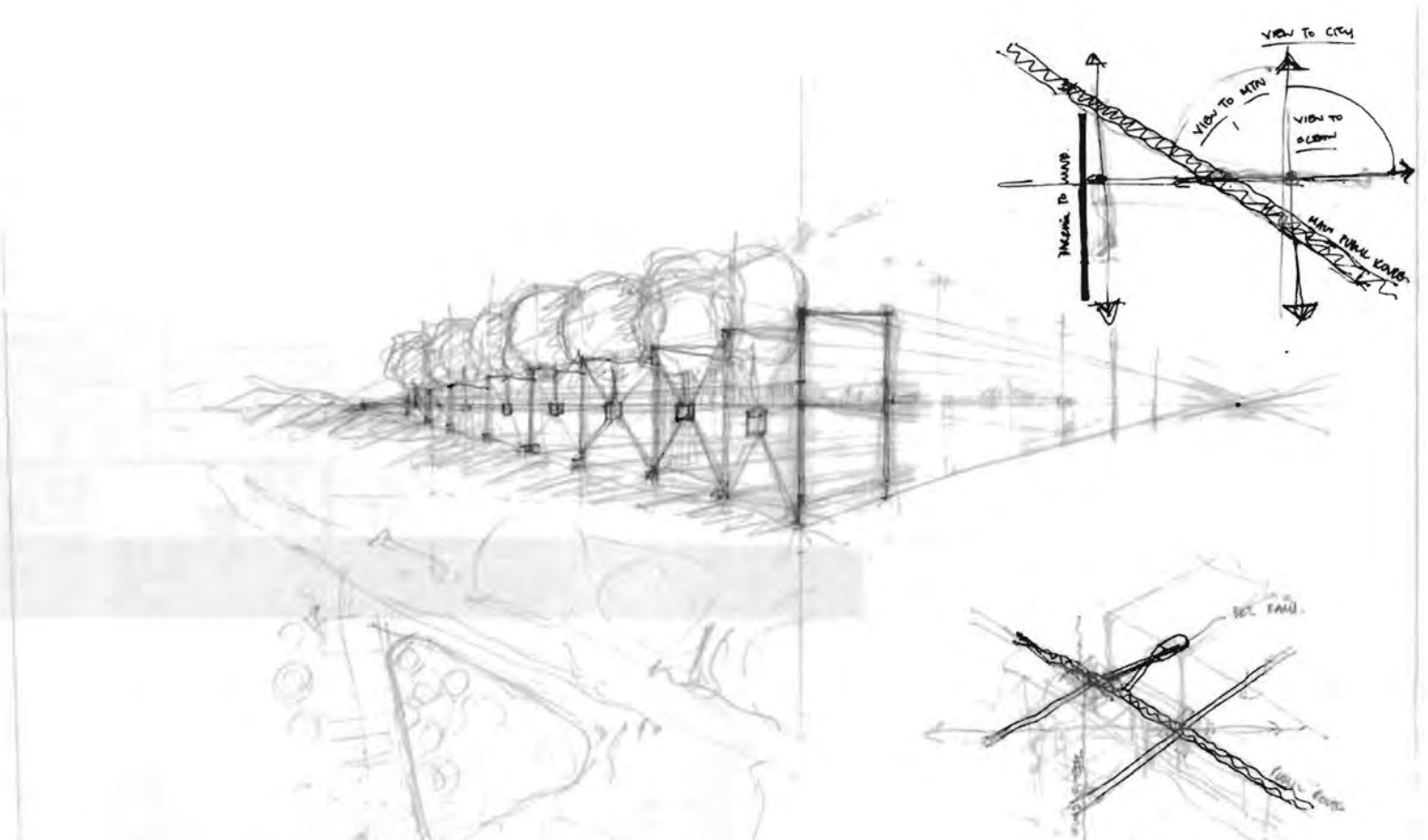


Figure 78 initial site drawings representing ideas of technology

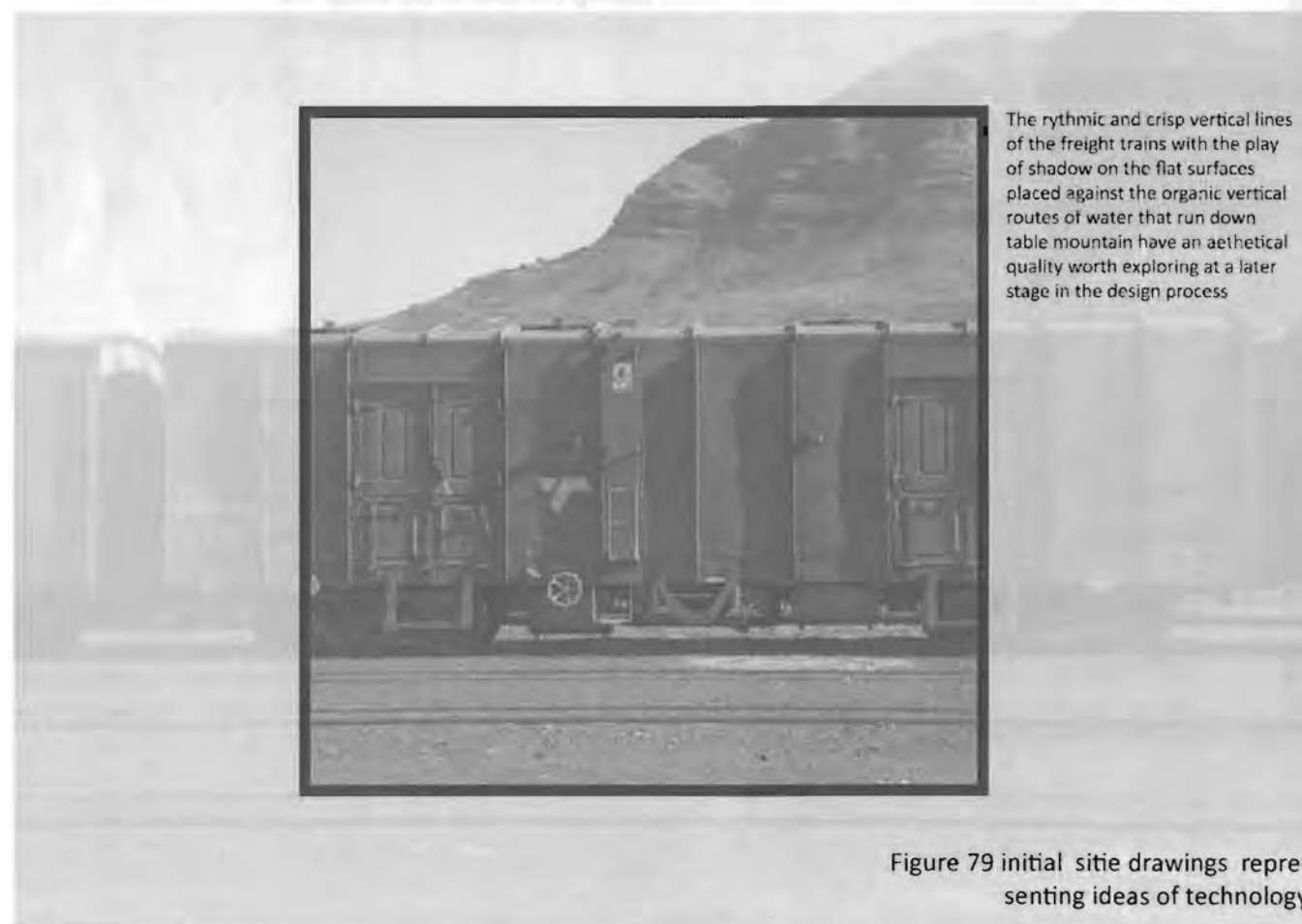


Figure 79 initial site drawings representing ideas of technology

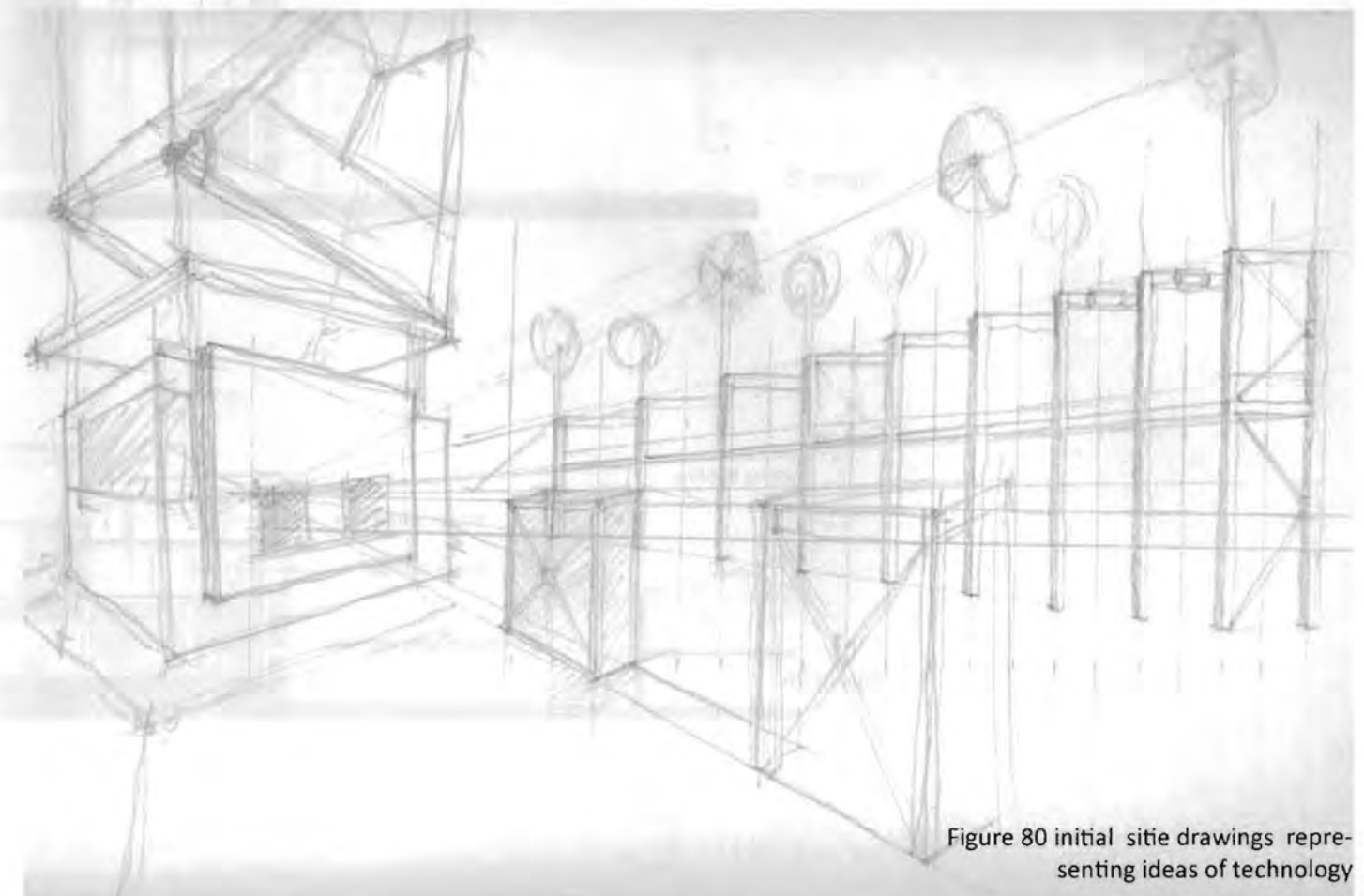


Figure 80 initial site drawings representing ideas of technology



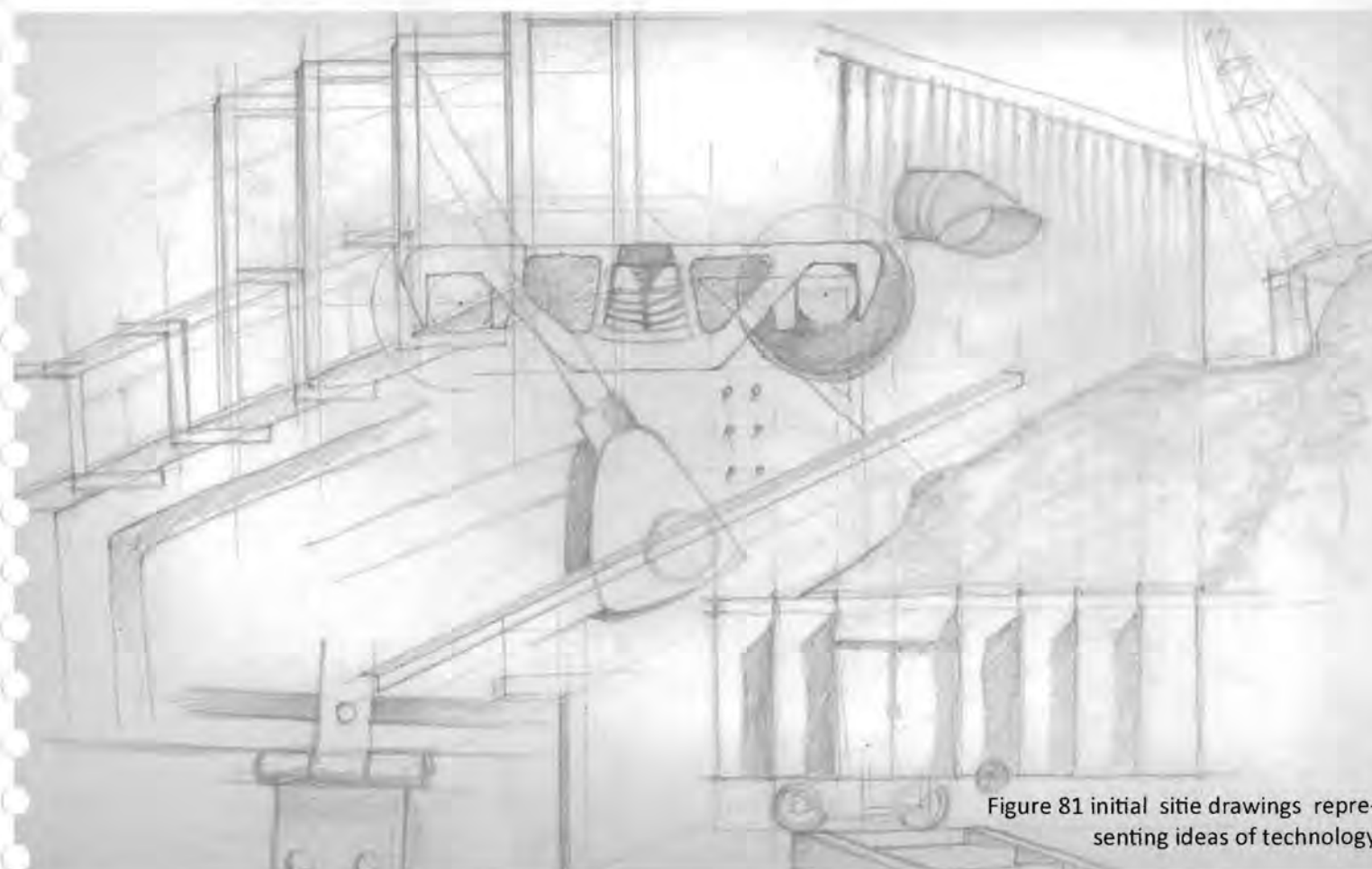


Figure 81 initial site drawings representing ideas of technology

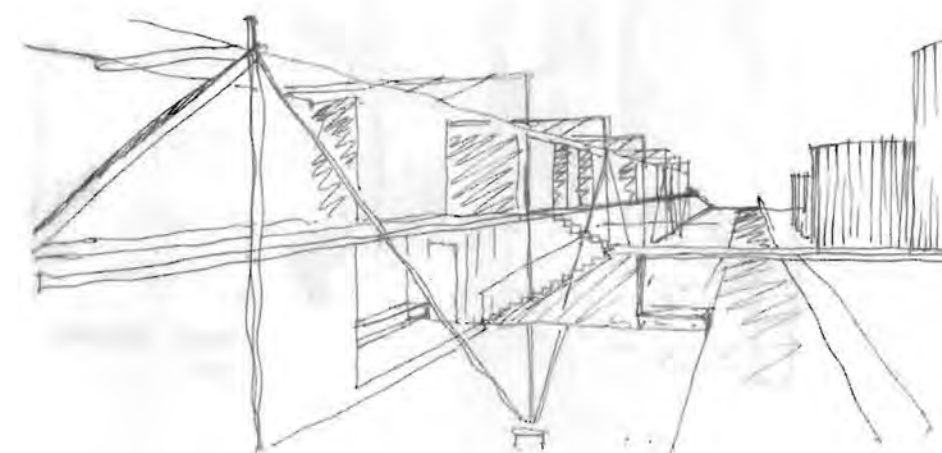


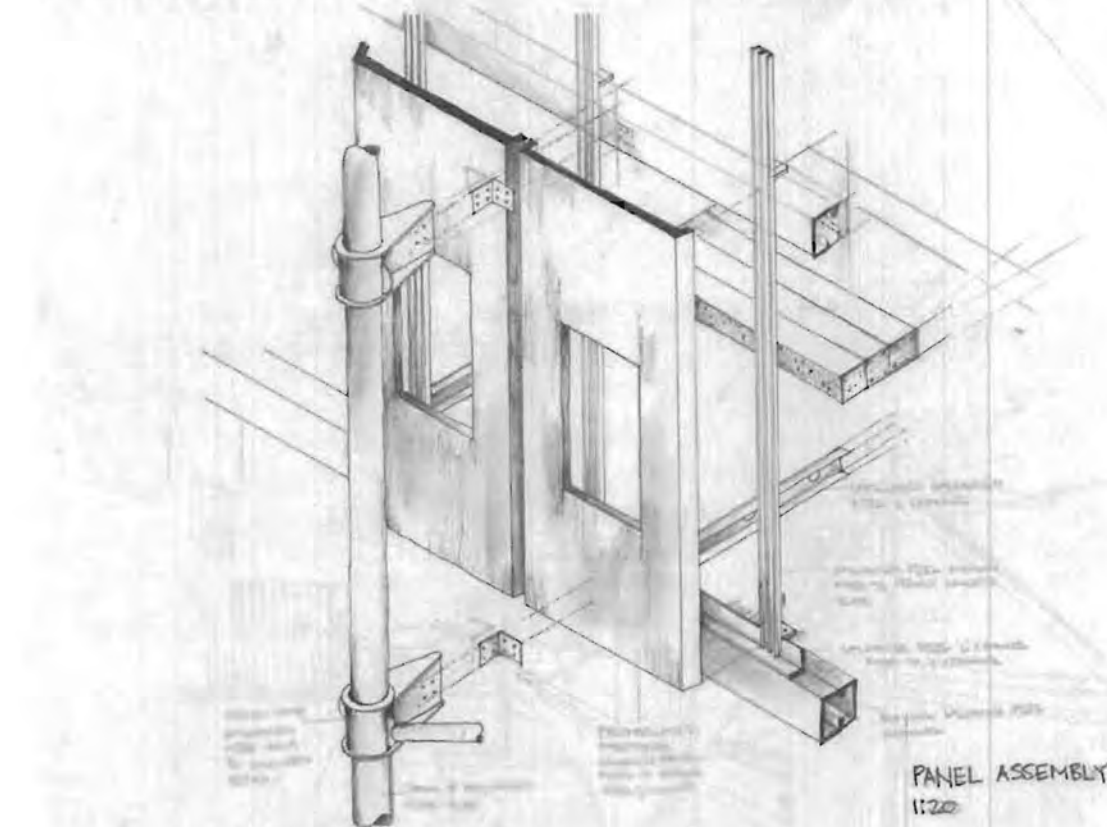
Figure 82: initial site drawings representing ideas of technology

### Technical Development

From the early sketches illustrated alongside the project was always going to be expressive in its structural components. The drawings illustrate the robust and tactile nature of the surrounding context. The idea was to carry part of these initial technical interests into the design development of the project. From the technical research document the project has developed according to the following principles. Firstly with reference to the basic structural logic of a ship as a box girder this project intends to address the long spans through the creation of a building that is essentially a truss. This idea was then developed in the initial design solutions as illustrated in the mid year design development proposal, whereby the building expresses the diagonals and structural logic of a conventional truss system.

However the diagonals of the structure created interruptions in the spatial qualities. Therefore the development of this idea was then to respond to extraordinary views of the surrounding context and to free up the buildings spatial experience. In order to achieve this design goal the truss is not conventional in the sense that the axial forces are expressed through a series of diagonals, instead the building takes the form of a vierendeel truss that opens up the views and allows for greater spatial (accessibility) qualities. Furthermore this allows the design of the project to pick up on the various vertical and horizontal rhythms that make the differing components of the building structure. These rhythms refer to the structural rhythms set up by the grid of the vierendeel cords (6meter), the vierendeel columns that relate to the spacing dictated by the conditions of the site (varies with a maximum of 18 meter span) and the rhythms of the prefabricated sandwich panels (120mm width) that are assembled onto this primary structure. It was always in the design intent to express these different layers of structure and materiality that then begin to set the architecture of the bridge building. The combination of rhythms is seen in figure 88

Figure 83  
Drawings from Mid Year Re-  
view Presentation



Section through dormitory and bridge. In this drawing the bridge and the building were separate, later developments see the integration of these elements into one, building. This section also shows dormitories on the same level of the bridge. Development of this idea was to take dormitories above and leave bridge level as public domain and primary link of woodstock to harbour.

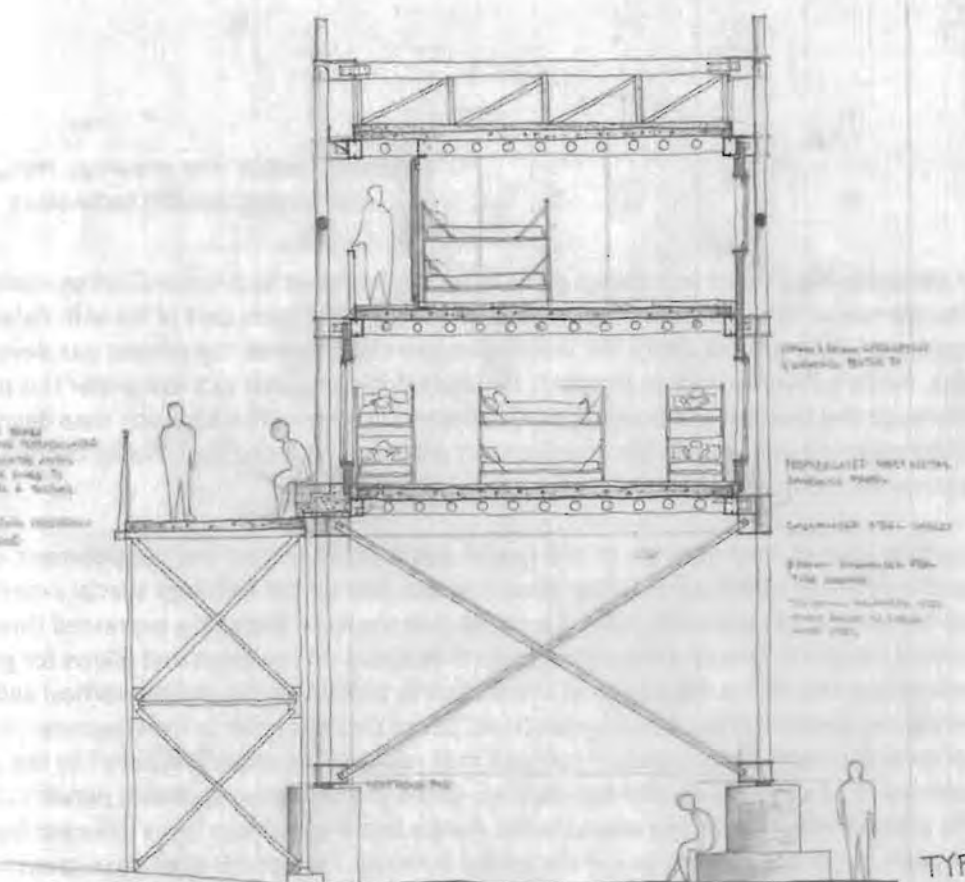
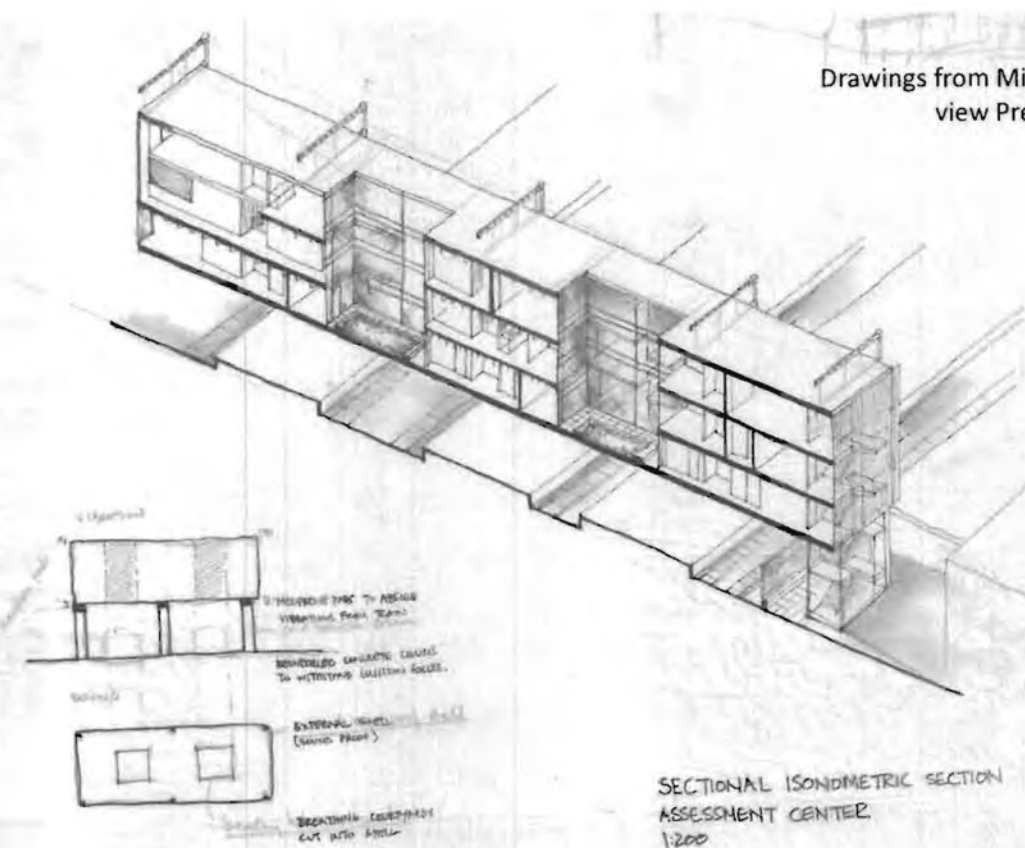


Figure 84  
Drawings from Mid Year Re-  
view Presentation

Figure 86  
Drawings from Mid Year Re-  
view Presentation



TREE COVERED SQUARE  
ADJACENT TO BRT STATION  
1:200

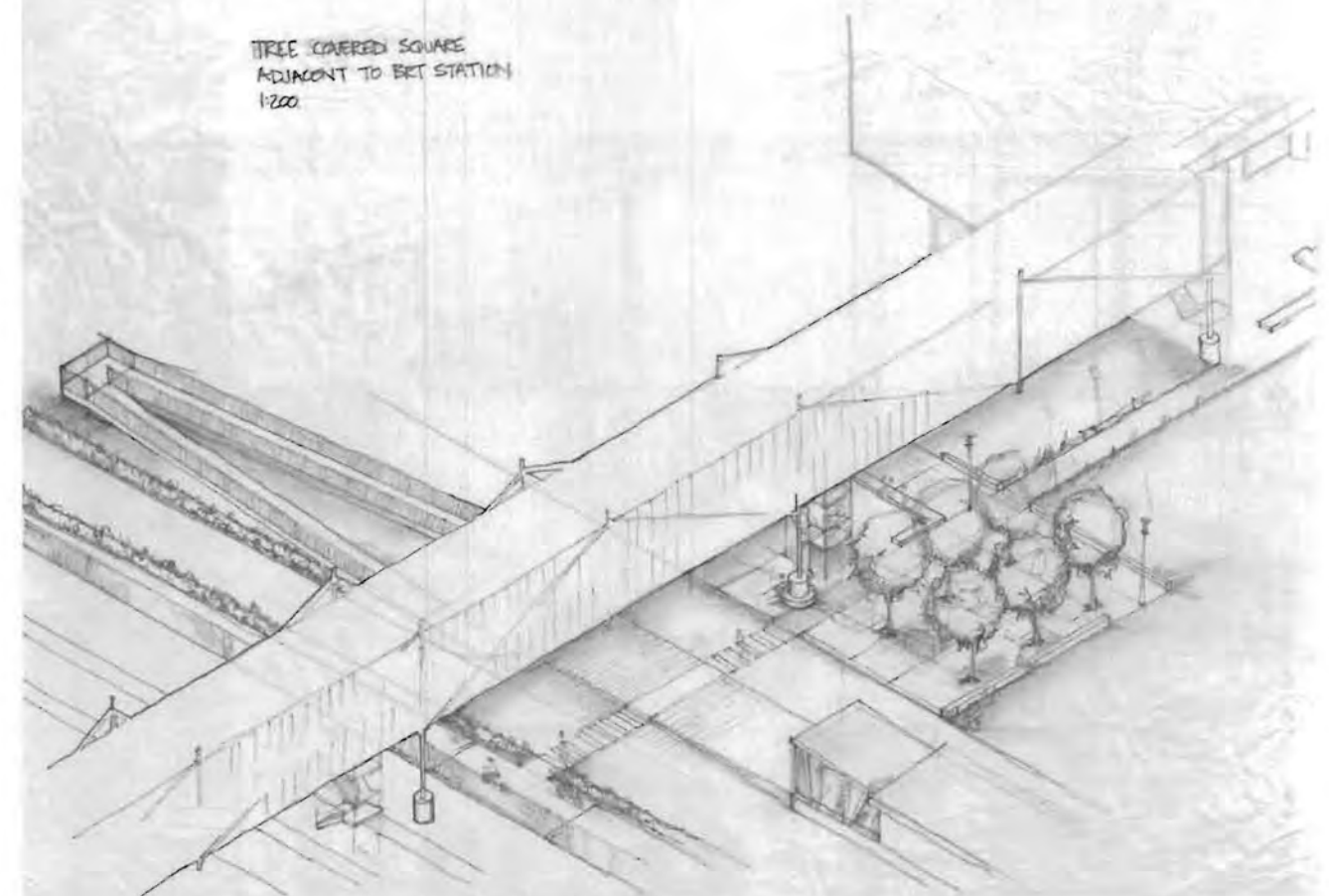
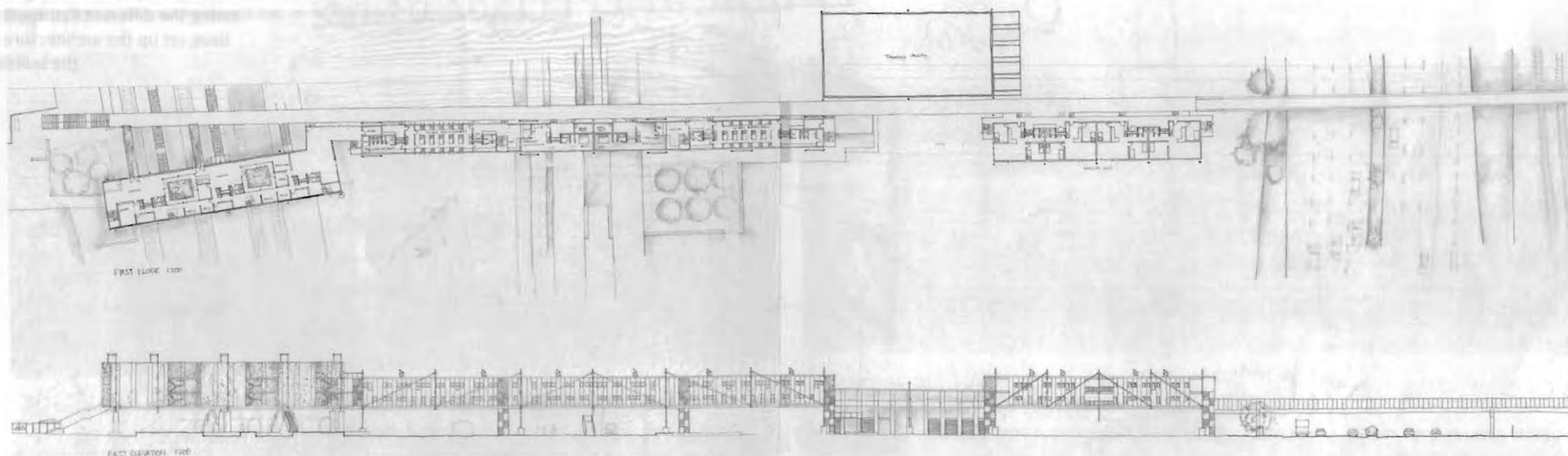


Figure 85  
Drawings from Mid Year Re-  
view Presentation

Mid Year Review development  
of the building a truss combined  
with the initial ideas of the spatial  
layout of programme along the  
length of bridge corridor.

Figure 87  
Drawings from Mid Year Re-  
view Presentation





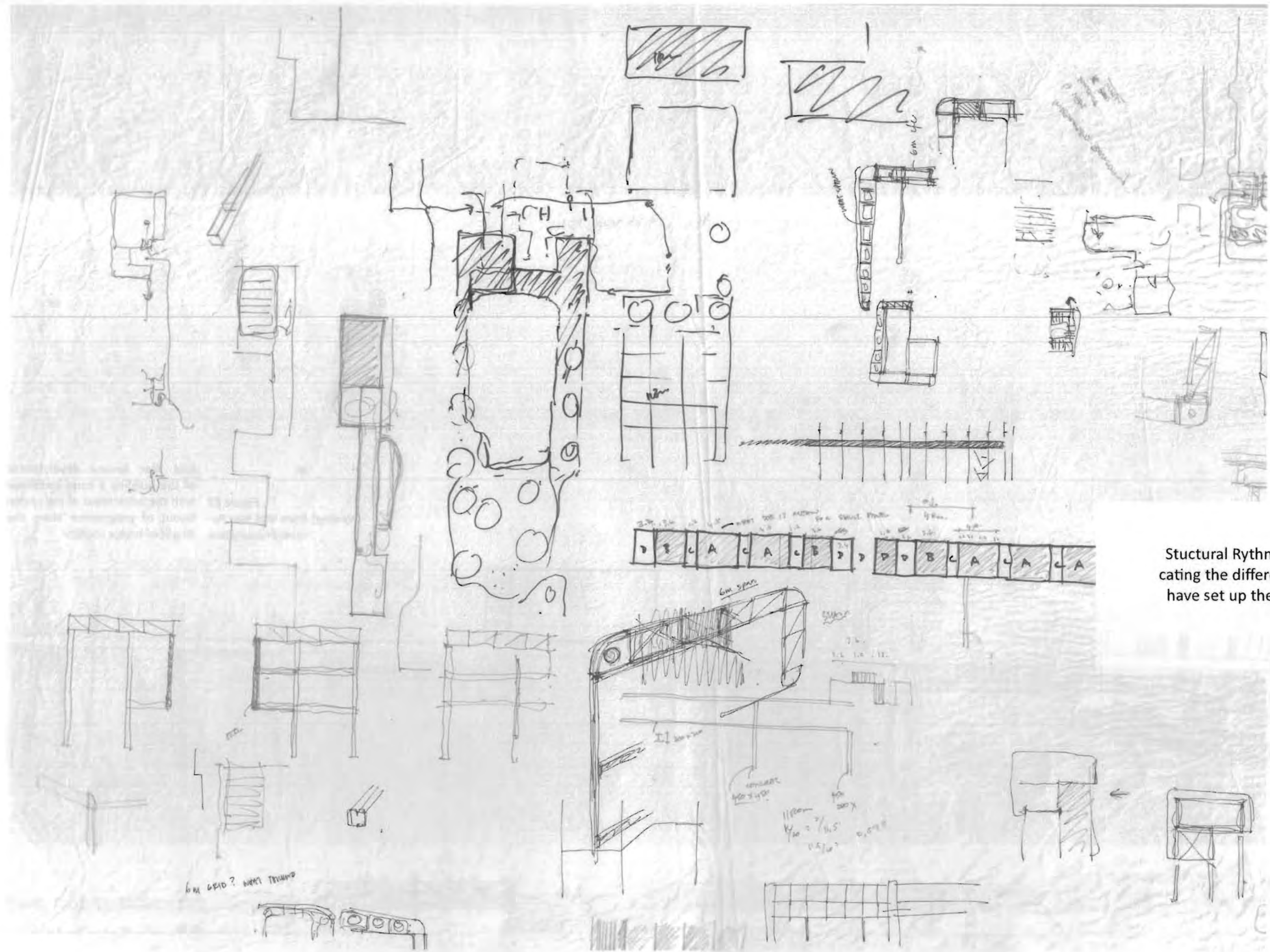
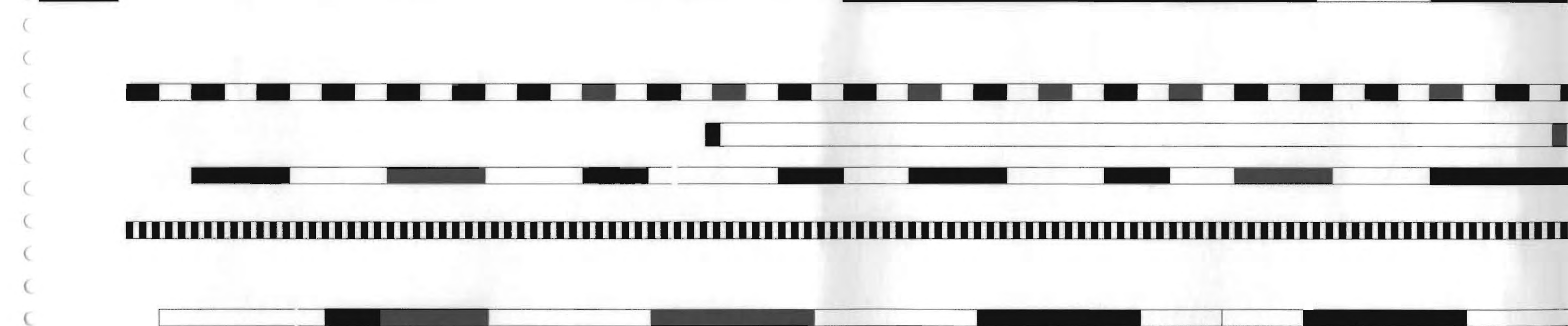
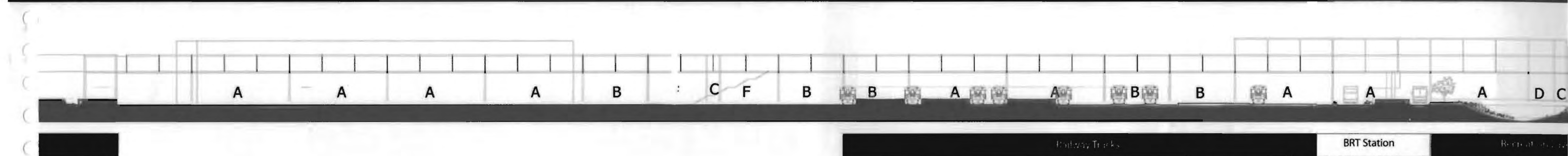
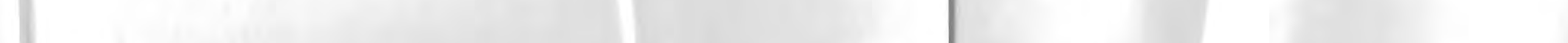
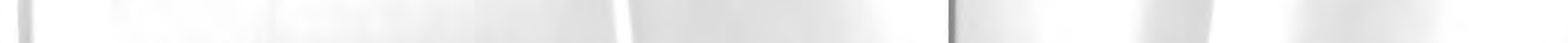
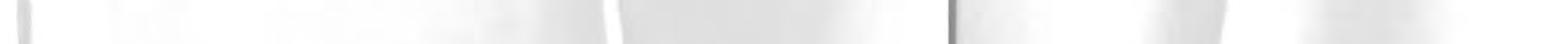
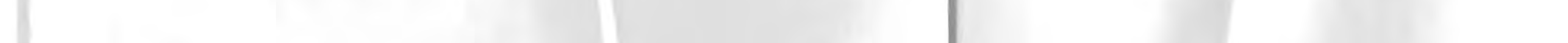
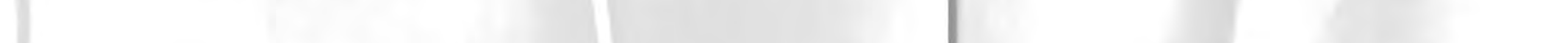
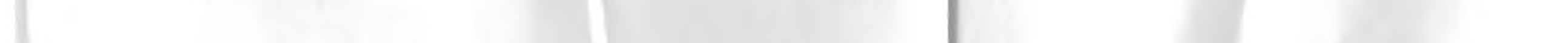
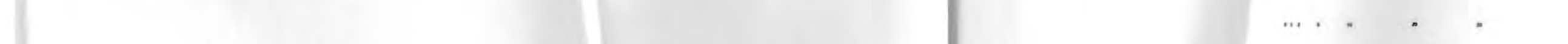
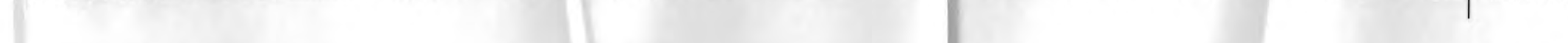
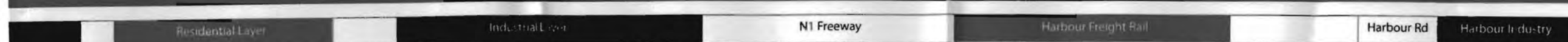


Figure 88:  
Structural Rhythms Drawing indicating the different Rhythms that have set up the architecture of the building





Rythm set up be the existing conditions of teh site, regarding, Espanade Station, Shunting yard Tracks, BRT Station, N1 Freeway and the Harbour Frieight lines and by the urban design scheme

Subsidary columns for veriendeel set at 6 meter intervals

Service core rythm set up by a 30meter grid system.

Column grid set up by the condition on the ground

rythm set up by the measure of 1200mm panels used in the prefabricated sandwich panel system

30 meter interval rythm for fire that sets up the escape stairs which has also been used to organise the service core rythm





Figure 31 Model 1

Figure 31 Model 1 is a conceptual sketch of a long, low building with a series of vertical supports or columns. The sketch is oriented horizontally, showing the building's profile and the spacing of the supports. The drawing is done in a simple, sketchy style with light lines.



Figure 32 Model 2

Figure 32 Model 2 is a conceptual sketch of a building with a flat roof and a series of vertical supports or columns. The sketch is oriented horizontally, showing the building's profile and the spacing of the supports. The drawing is done in a simple, sketchy style with light lines.



Figure 33 Model 3

Figure 33 Model 3 is a conceptual sketch of a building with a complex, multi-level structure and a series of vertical supports or columns. The sketch is oriented horizontally, showing the building's profile and the spacing of the supports. The drawing is done in a simple, sketchy style with light lines.

## 3D digital Modelling of structural exploration

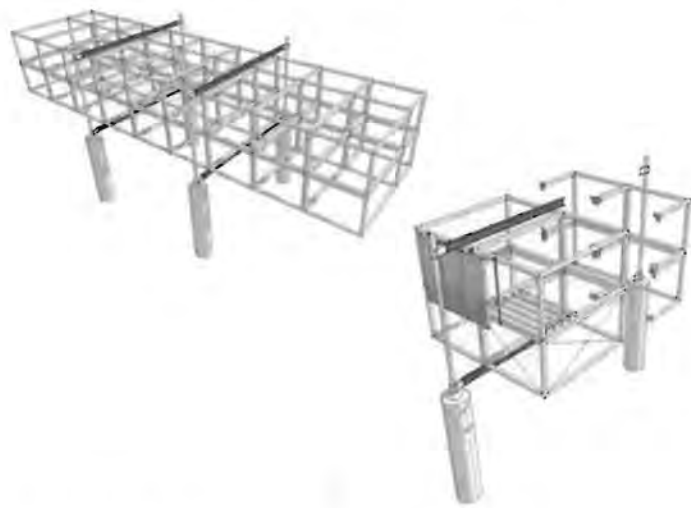


Figure 89: Model 1

## Module

In this exercise the vierendeel developed into a module without a reference to site, it had no point at which it would stop it could simply continue to grow. From this module, the rhythms for the structure logic were then to be taken further and combined with a site specific design idea.

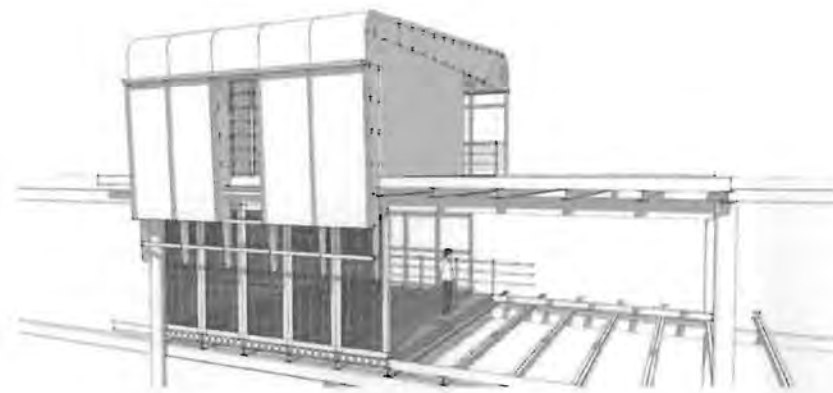


Figure 90: Model 2

Metal Fins, combination of exposed and cladded structure

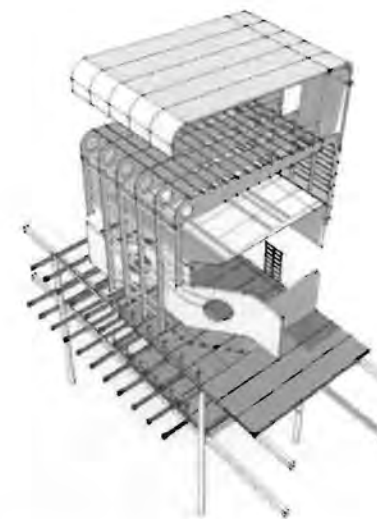


Figure 91: Model 3

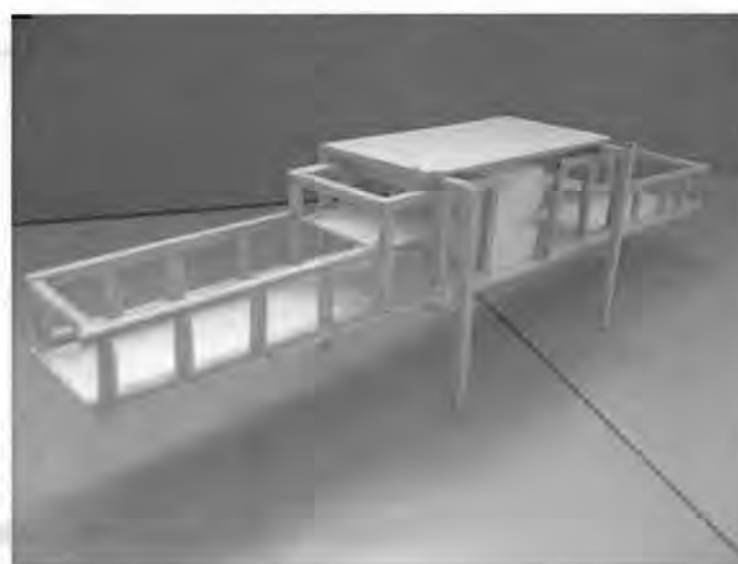
Revealing of the different structural components, Vierendeel, Rounded roof truss/screen and the H Shaped Service Cores providing lateral stability.

In this drawing the 'metal fins' from the previous drawing have developed into a lighter more conventional truss system, placed at a wider spacing of 3meter intervals



Figure 92: Model 4

Cladding system started to become a folding element that wrapped around the primary structural elements. This was abandoned as it was not apart of the initial design ideas for structural expression



3D digital Modelling and structural exploration:  
These models have focused on the dormitory component of the building development in order to establish the structural principles that will then be applied to the rest of the building.



Figure 93:Physical Model Building Exploration of vierendeel Truss

the thin ribbed fins on the exterior of the building. The development of these ideas was explored through both physical and digital modelling of the different building components. In figure 90 (Model 2) the roof structure takes on the form of thin metal fins that act as both wall, roof and screen. The fins are light weight elements that are clipped onto the primary steel vierendeel structure. In this initial technical design development the structure was over designed, whereby the fins were at a spacing of 1200mm which is a common spacing for a ship's hull construction. The connections envisioned in this design were clearly expressed, with the thin metal fins being sandwich between two steel c channels supporting the precast concrete floor (figure). The development of this design took the principles established in this exercise and introduce them in a more refined and efficient structure.

The resulting system with regards to the light weight roof structure is a conventional truss system. As opposed to the thin metal blades of the initial design, the roof truss is made up of hollow steel RHS tubes that are prefabricated and then fixed to the primary steel structure. These trusses are also intended to act as the structure for wall, roof and screen. The layering of the different structural elements is expressed in the detail, by revealing the hierarchy of the different building components which is clearly represented in the exploded isometric drawing (figure 94). In this drawing it is also evident that the expressiveness of the primary structural components is combined with the rounded finish of the roof structure which makes reference to the forms of a ship's hull or even a trains carriage. As mentioned previously the roof truss has been designed to be roof, wall and screen, therefore on the western facade it extends 1200mm passed the edge of the concrete floor, becoming a large screen that intends to act as a wind filter. This structure also sets up bays into which other screening may be inserted for protection against horizontal west sun. This screening will come in the form perforated metal screens that are able to be opened to the views.

#### Service Cores

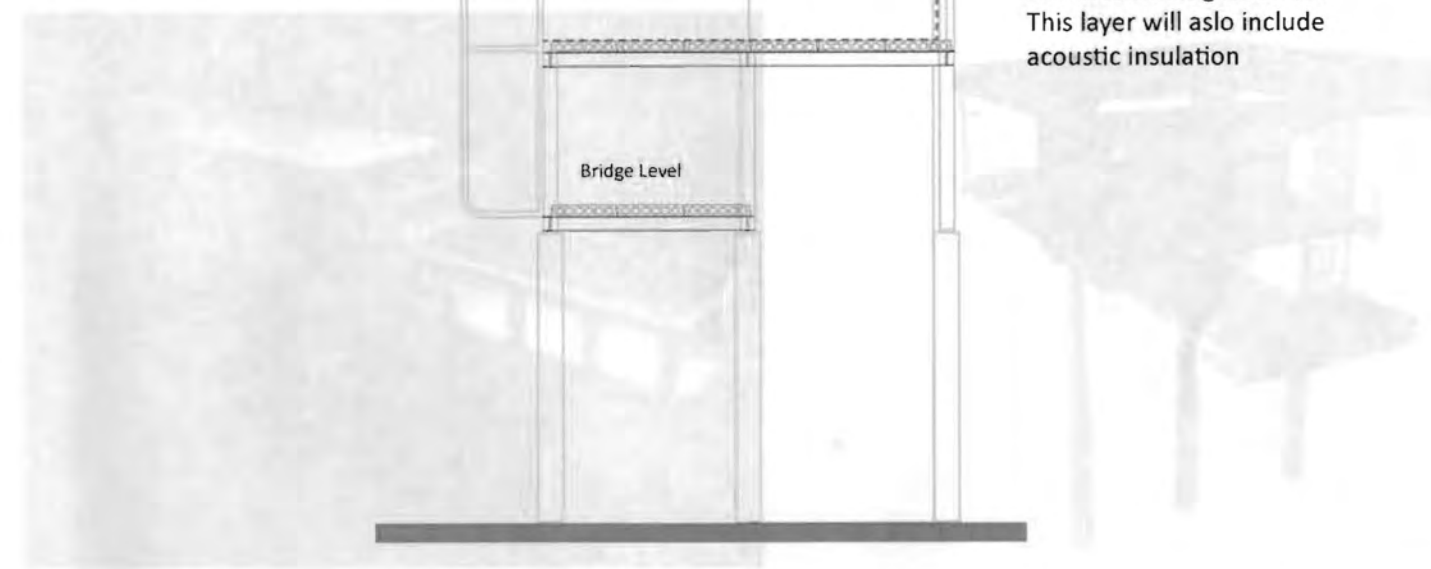
Another important component of the overall structure is the service cores that set up the buildings lateral stability. The





The structure is on the exterior of the building. The structure is a concrete wall that is part of the building's exterior. The wall is made of concrete and has a textured surface. The wall is located on the exterior of the building and is part of the building's structure. The wall is made of concrete and has a textured surface. The wall is located on the exterior of the building and is part of the building's structure.

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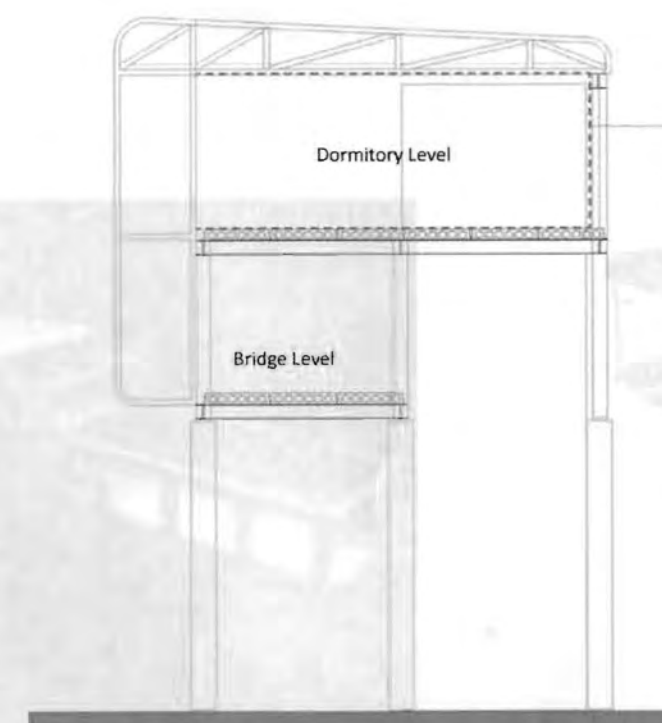


Figure 97:

Fire proofing strategy is to line the interior layer of the Dormitory Level with a Gypson fireboarding material. This layer will also include acoustic insulation

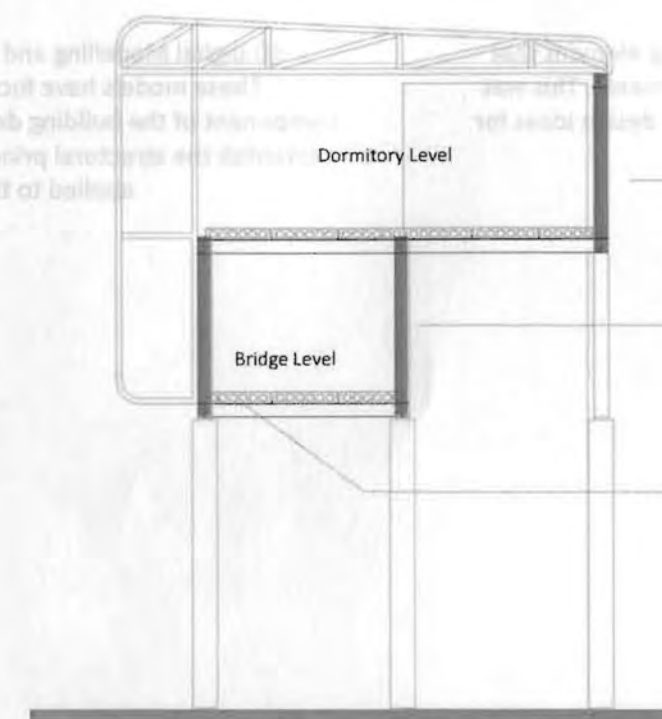


Figure 96:

Location of Vierendeel Trusses in short section of dormitory 'bridge'.

# Drawing Illustrates Main Prefabricated Components

Figure 94: Exploded Isometric Perspective of Dormitory Component

Prefabricated Corten Steel roof sandwich panel system

Perforated Metal Ceiling sandwich with fireboard and sound insulation.

Prefabricated steel roof truss constructed of 100 X 50mm galvanised steel RHS tubes. Bolted and fixed on site

Prefabricated Corten Steel sandwich panel

150 X 1200mm Precast Concrete floor slabs

254 X 254 mm galvanised steel H sections welded and bolted on site

Noeprene Pad at connction of Steel frame to concrete column

450mm X 450mm concrete column

50mm acoustic and fire insulation paneling, supported on steel subframe at 400mm centers

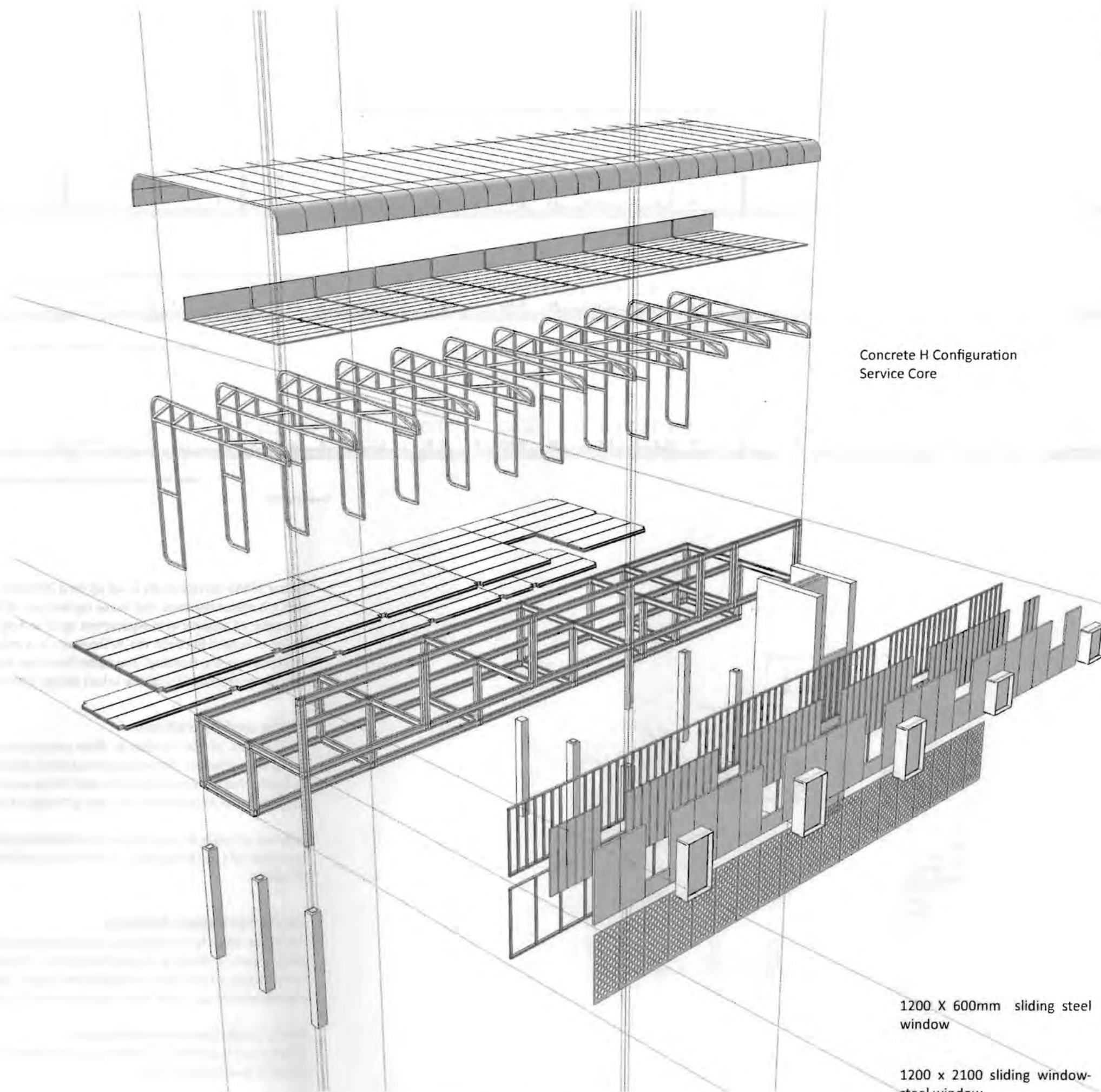
1200mm X 2700mm Prefabricated Corten Steel sandwich panel

1200mm X 2700mm perforated metal screening fixed to a 50 X 25 mm RHS sub frame.

Concrete H Configuration Service Core

1200 X 600mm sliding steel window

1200 x 2100 sliding window-steel window.



Initial concept sketches illustrating service cores and ideas of water recycling

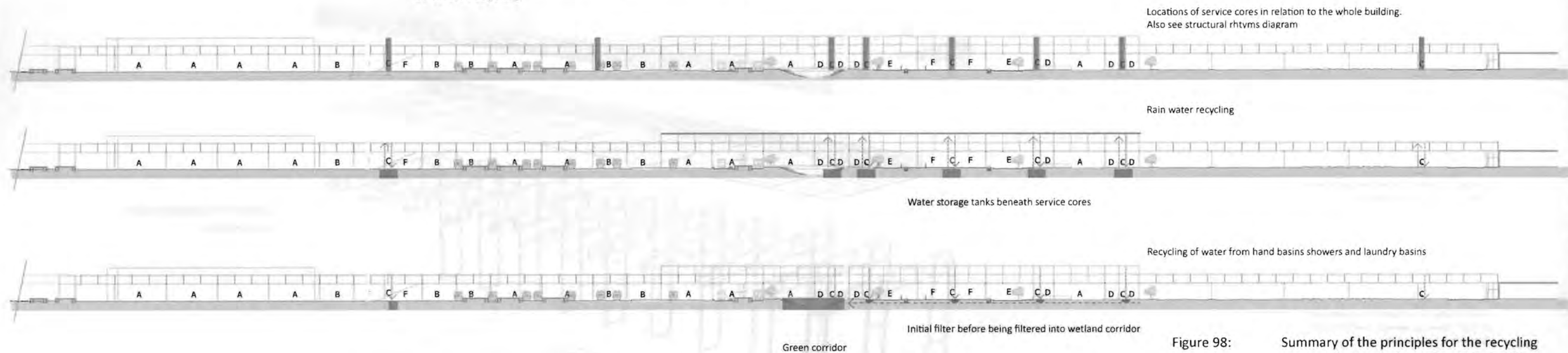


Figure 98: Summary of the principles for the recycling of water in throughout the building

layout of the service cores is set up on a 30meter rhythm which ties up with the fire escape distances as well as the 6 meter and 1.2 meter rhythms that make up the rest of the buildings structure. The cores have taken on an H shape configuration whereby all pipping and equipment such as hot water geysers and water filters can be stored and easily accessed in the event of repair. Beneath the H-Structure is a storage tank for the rainwater which is then intended to be pumped up and recycled into the building. The water from the laundries, and wash hand basins will be brought down filtered and released into the green corridor of the urban design scheme (figure 98)

### Noise and Vibrations

The location of the building in close proximity to the highways railway lines has also provided the design challenge of noise and vibration. These issues have been dealt with in simple terms. The vibrations are dealt with at the point where the concrete stub column meets the steel truss system. That connection is accompanied by a neoprene pad that helps absorb the vibrations experienced by passing transport vehicles (see figure 94) .

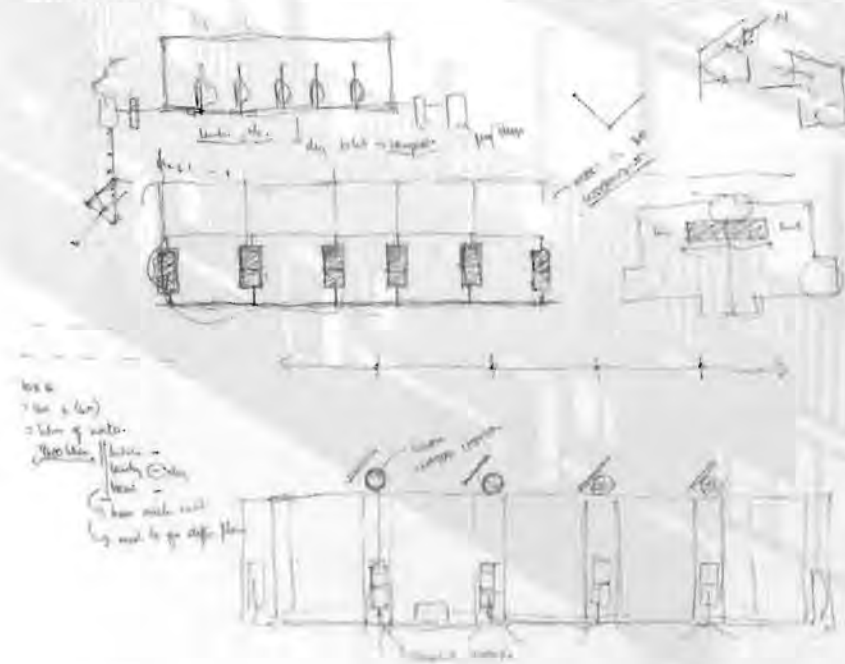
In terms of noise the conditions, the thickness of the Vierendeel Truss, offers enough space in the wall construction, to set up a layer of sound insulation, that will be used in combination with perforated steel sheeting that will assist in the diffusing of sound.

### Implementation Strategy

The initial ideas for the projects implementation is for the workshop and skills development building to be constructed first, using a mix of skilled and unskilled labour. Once the workshop has been completed, this facility will then be used for the construction of the main prefabricated metal components for the next two phases of the project.. The projected is to be phased according to the following sequence (figure 99):

- Phase 1 Skills Development Workshop
- Phase 2 Service cores and Dormitory Accommodation
- Phase 3 Assessment Center

Conceptual ideas of Water Recycling system





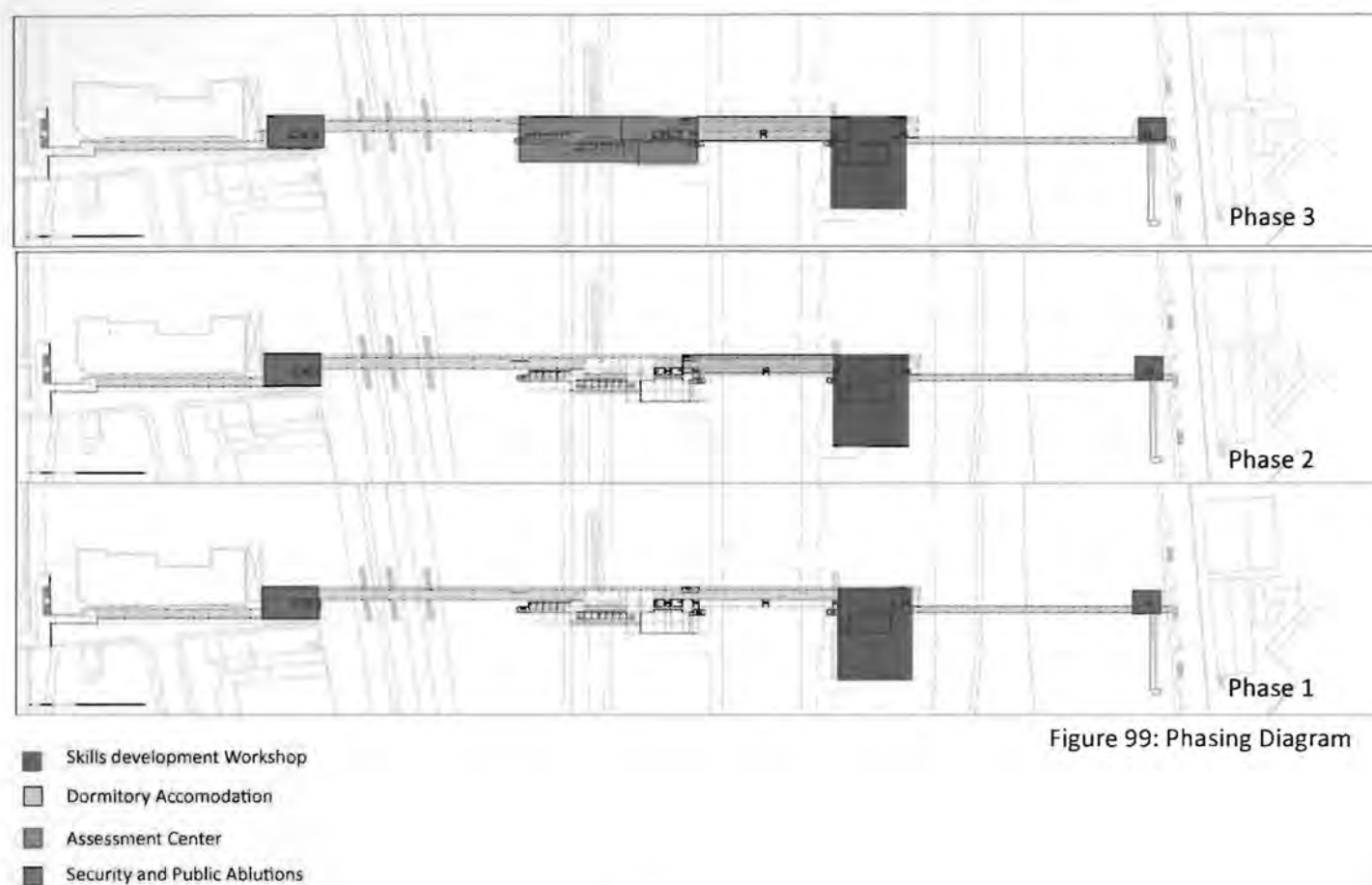


Figure 99: Phasing Diagram

## section 6

### CONCLUSION

The design process began with a site specific approach which led to the theoretical research in the fields of space syntax, lost spaces and the urban design theories of place, link and figure ground, combined with the technological exploration of ship construction, metal surfaces, and the prefabrication genius of Jean Prouve. This research and the thorough site investigation into both its social and physical attributes has produced an interesting and richly layered project that has led to challenges involving the social issues of unemployed people coming into the city as well as dealing with a building structure that needed to span long distances in order to bridge the barriers presented by the transport infrastructure of the Culemborg goods yard.

The design grew from the initial vision for a series of integrated bridges that would function as links integrating the barrier of Culemborg Goods yard while supporting the growing harbour and providing opportunity for skills development and orientation for people coming into the city in search of work. The journey originated from a need to respond to the person on the street, through means of social engagement that would lead the project to a design solution that went deeper than its technological and physical realization. In this process the social engagement and research directed and guided the design process with regards to the programming and in the technological development. However the process has shown that the social condition is not the only element driving the design but there is a constant push and pull between many different elements as seen in the site analysis component of this design report, each trying to find a balance. The physical conditions of the site itself become a very important aspect of the design process, dictating certain constraints and possibilities that in this instance have provided an opportunity for a structure that utilizes rhythms, some constant while others were required to skip or adjust in order to facilitate the constraints and limitation posed by the site. In this exploration the project gains a constant layering of information adding to the spatial experience and helping create an architecture that responds at many different levels in terms of the urban condition through the 'linking bridge'; the social, in terms of opportunities for assessment and skills development and the site specific conditions with regard to the building's materiality and making. By means of this process and design approach the project has aimed at creating a truly integrated bridge that acts as a 'metal link' for the integration of city to sea and people to city.



Figure 1

## Section 6

The building is a two-story structure with a central vertical element. The plan view shows a rectangular footprint with internal divisions. The section view shows a cross-section of the building with a central vertical element. The building is a two-story structure with a central vertical element. The plan view shows a rectangular footprint with internal divisions. The section view shows a cross-section of the building with a central vertical element.

The building is a two-story structure with a central vertical element. The plan view shows a rectangular footprint with internal divisions. The section view shows a cross-section of the building with a central vertical element. The building is a two-story structure with a central vertical element. The plan view shows a rectangular footprint with internal divisions. The section view shows a cross-section of the building with a central vertical element.

# section 7

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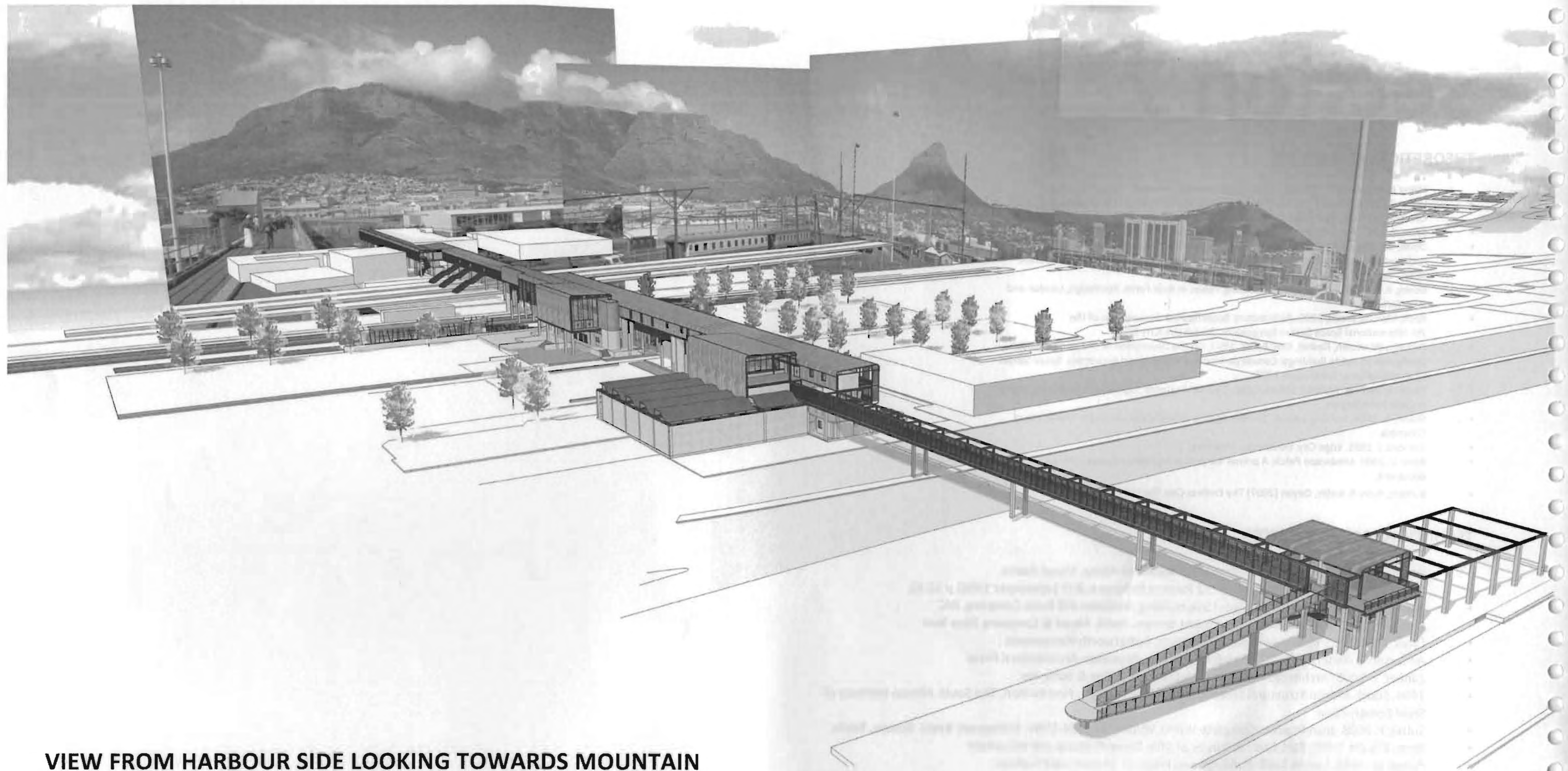
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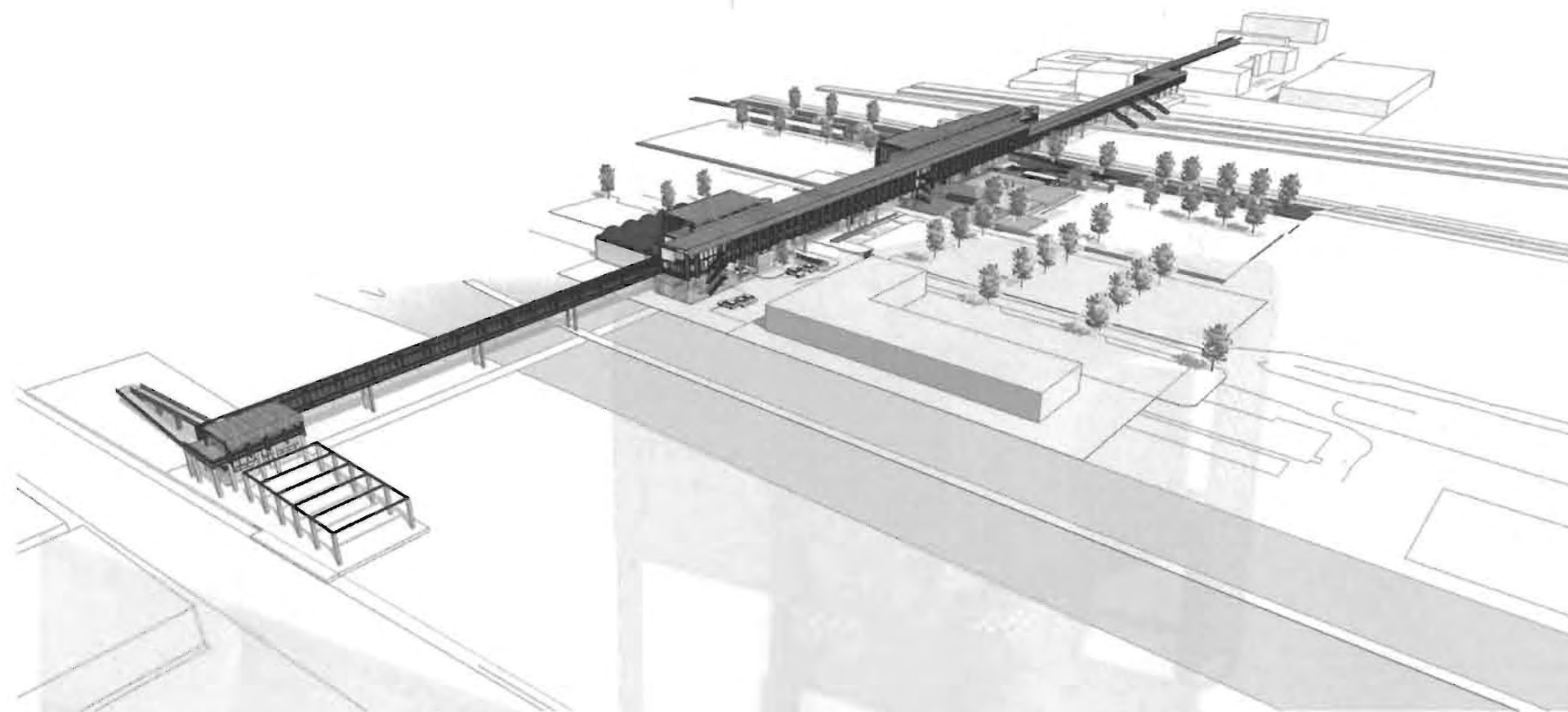


# appendix

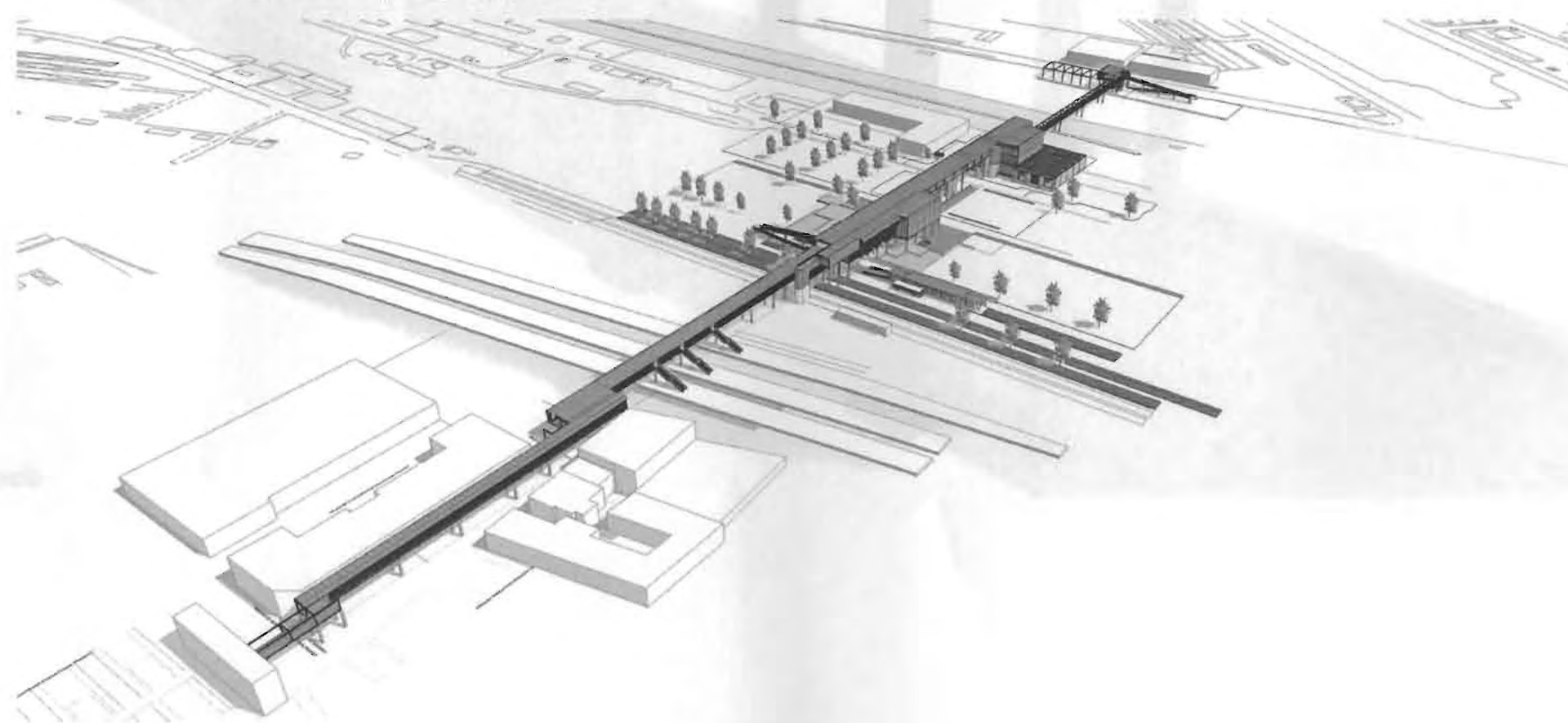
EAST ELEVATION 1:200



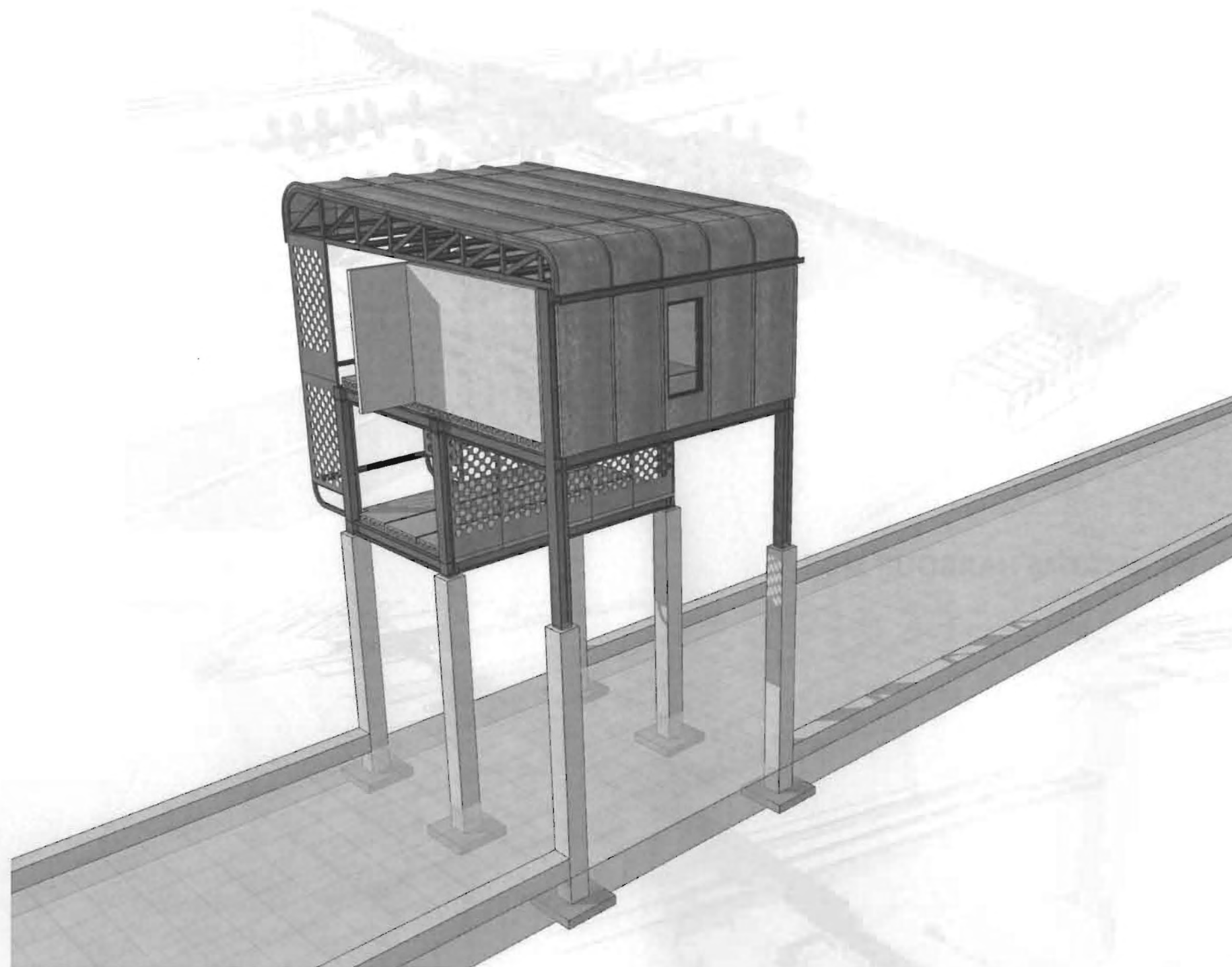
VIEW FROM HARBOUR SIDE LOOKING TOWARDS MOUNTAIN



**VIEW FROM HARBOUR SIDE**

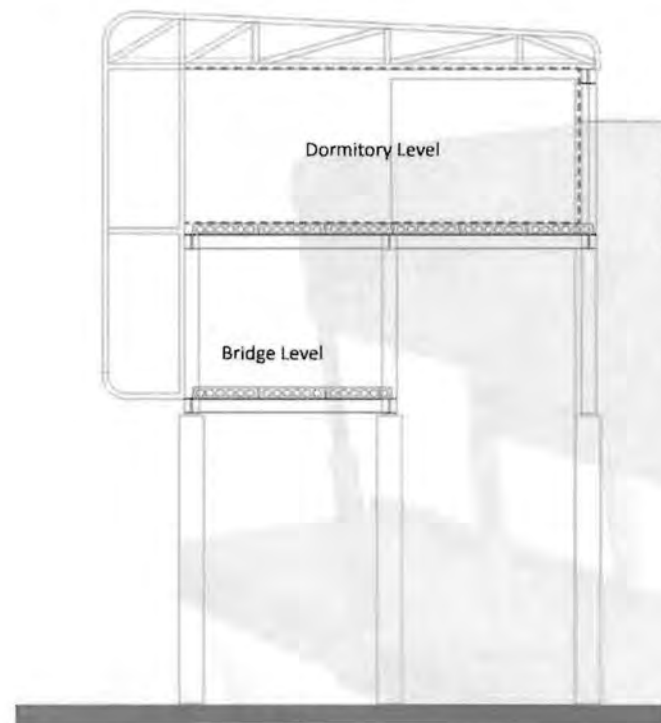


**VIEW FROM WOODSTOCK SIDE**

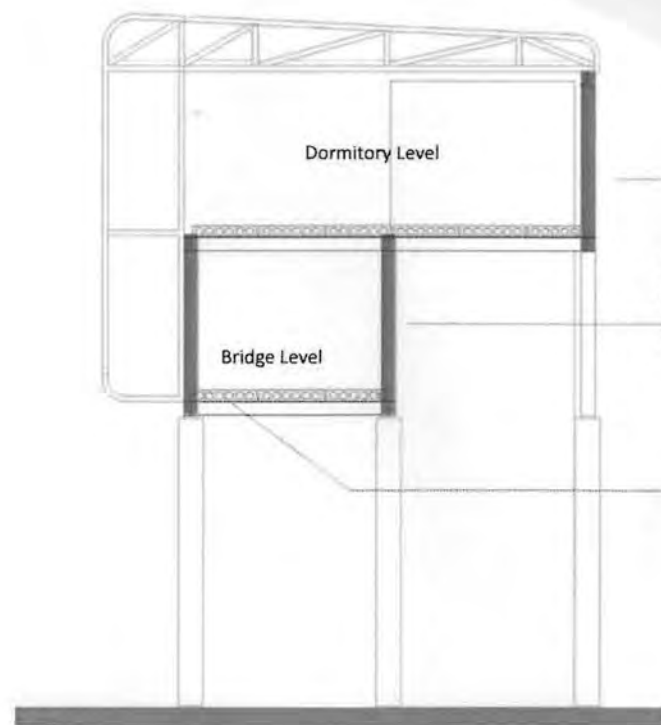


dormitory module

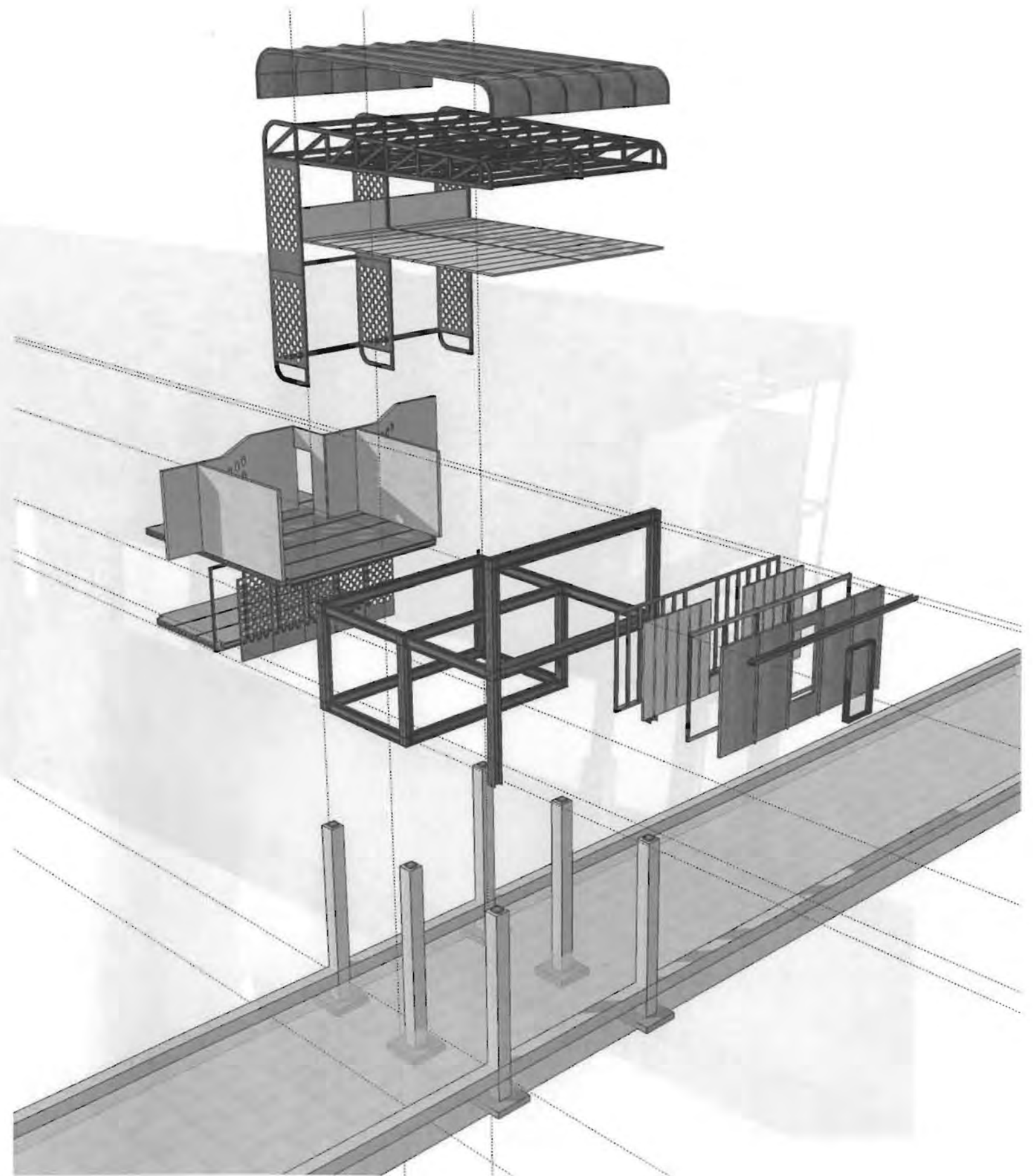




Fire proofing strategy is to line the interior layer of the Dormitory Level with a Gyp-son fireboarding material. This layer will aslo include acoustic insulation



Location of Vierendeel Trusses in short section of dormitory 'bridge'.





dormitory module combined with service core

Prefabricated Corten Steel roof sandwich panel system

Prefabricated steel roof truss constructed of 100 X 50mm galvanised steel RHS tubes. Bolted and fixed on site

Perforated Metal Ceiling sandwich with fireboard and sound insulation.

111mm Fibre Concrete prefabricated sandwich panel

150 X 1200mm Precast Concrete floor slabs

1200mm X 2700mm perforated metal screening fixed to a 50 X 25 mm RHS sub frame.

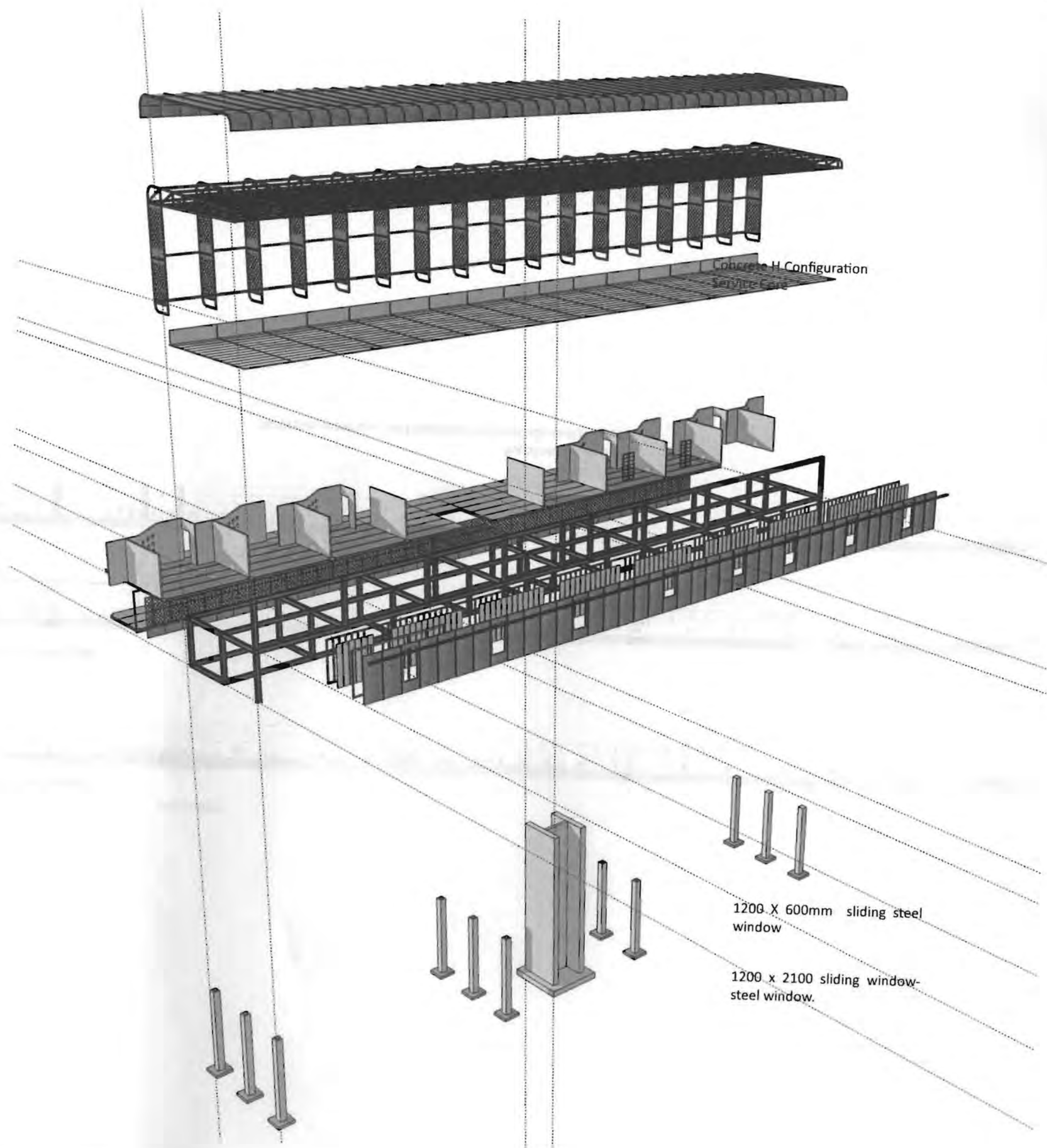
254 X 254 mm galvanised steel H sections welded and bolted on site

50mm acoustic and fire insulation paneling, supported on steel sub-frame at 400mm centers

1200mm X 2700mm Prefabricated Corten Steel sandwich panel

Noeprene Pad at connction of Steel frame to concrete column

450mm X 450mm concrete column





Initial concept sketches illustrating service cores and ideas of water recycling

Locations of service cores in relation to the whole building.  
Also see structural rhythms diagram

Rain water recycling

Water storage tanks beneath service cores

Recycling of water from hand basins showers and laundry basins

Initial filter before being filtered into wetland corridor

Green corridor

Figure 98:

Summary of the principles for the recycling of water in throughout the building

Concrete Service Core. Housing  
water recycling system and add-  
ing lateral stability to building.  
Service cores located at 30 m in-  
tervals

Laundry

Showers

Filtered Grey water used for landscaping

Hand Basins

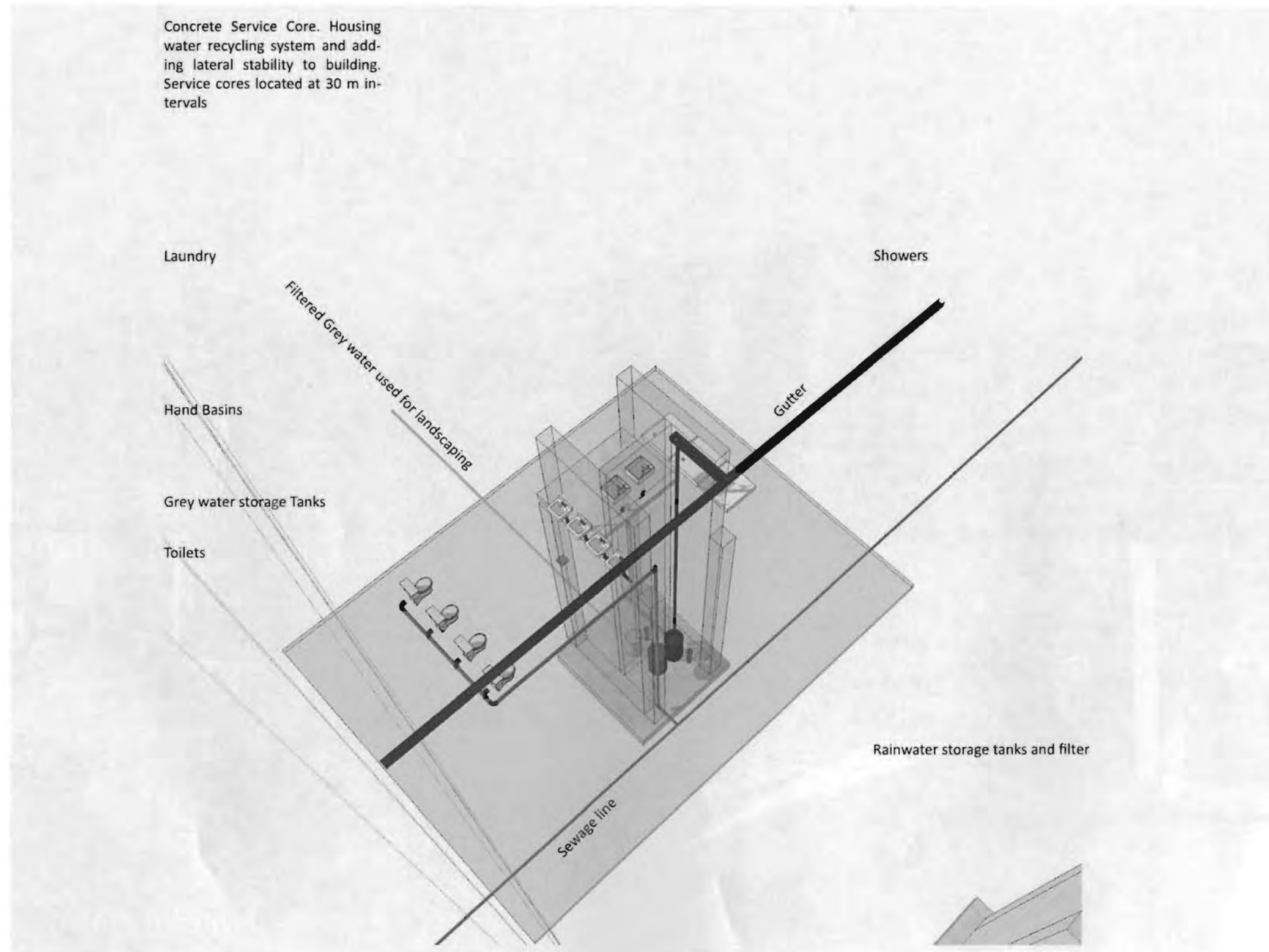
Gutter

Grey water storage Tanks

Toilets

Rainwater storage tanks and filter

Sewage line





Elevation from BRT Station





Public platforms



Entrance Foyer



Multi-purpose hall





Skills Development & Harbour Entrance Foyer



Business Education Centre



Canteen





Games Room